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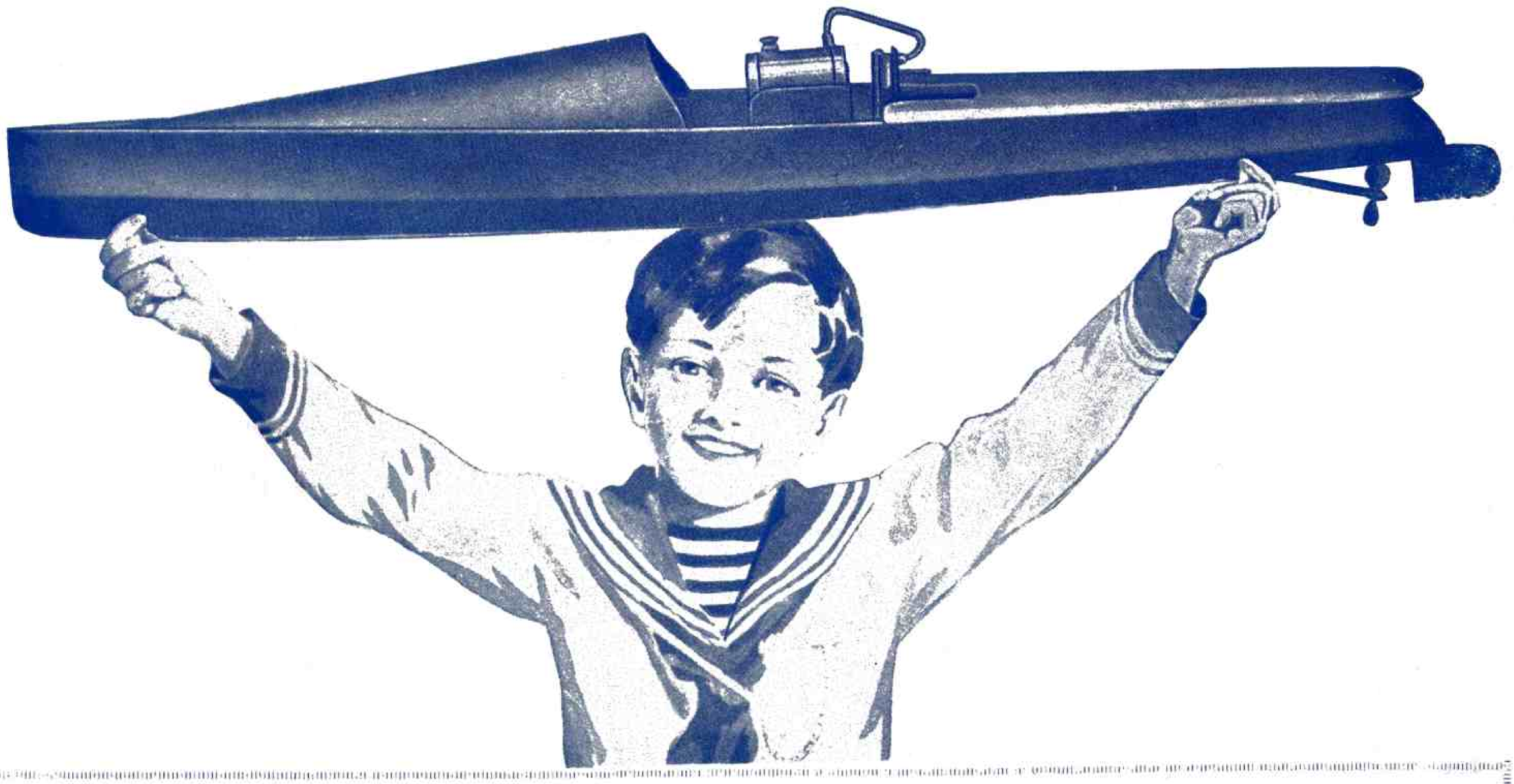

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MECCANO MAGAZINE

PUBLISHED IN THE INTERESTS OF BOYS

March 1925

EDITORIAL

Our Cover

THIS month our cover shows the "*Mammoth*," a giant Pontoon Crane belonging to the Mersey Docks and Harbour Board, who kindly supplied the photograph used as a basis for our cover. The illustration shows this great crane hoisting a massive dock-gate into position at the Liverpool Docks—an incident that occurred recently. The "*Mammoth*" was described and illustrated in the "*M.M.*" for November 1921. It is a self-propelling floating crane, capable of handling loads up to 200 tons, and is of the derricking-jib type. A valuable asset to the Port of Liverpool, it is constantly called upon to perform heavy weight-lifting feats. The crane is carried on a pontoon 154 ft. in length, with the crane arm so placed that the maximum outreach may be obtained either over the side or over the stern of the vessel. This feature in its construction is particularly valuable in handling heavy loads over the gates of large graving docks, in narrow entrances, and in restricted places. For further particulars of this great crane my readers are referred to No. 21 of the "*M.M.*" This month our magazine might almost have been announced as a special "Floating Crane" number, for in addition to our coloured cover showing the "*Mammoth*," we have an article on the largest floating crane in the world, recently built in this country for the Japanese Government, and also an article describing the construction of a Meccano model of Crane-Lighter No. 4, the property of the Admiralty. Cranes of all types have always been favourite objects with my readers and tens—or even hundreds—of thousands of Meccano models of cranes must have been built at one time or another. I have no doubt that the interesting information contained in this issue will result in the construction of a further large number of models, which this time will effectively reproduce the magnificent Crane-Lighter No. 4 in Meccano.

Famous Engineer's Choice

I have recently read that from a list of 500 of the world's greatest inventors, scientists, and philosophers, Mr. Henry Ford has chosen 21 names. The first three are Luther Burbank, Thomas A. Edison, and John Burroughs. Other names in his list of honour are :—Darwin, Da Vinci, Fulton, Bell, Wright, Diesel, Curie, Newton, Pasteur, Ampere, Franklin, Whitney, Marconi, Kirby, Faraday, Otto, Dunlop and Galileo. When I read the list I wondered how many of my readers are familiar with all these famous names selected by Mr. Ford—who, by the way, surely deserves a "place in the sun" also. In order to discover this, I offer a prize of a cheque for a guinea for the best account of these men—dates and places of births and deaths (where possible), and a description of their greatest achievement—allowing fifty words only for each name. Now boys, get out your encyclopædias, visit your reference libraries—or, if both these fail you, ask father! (Perhaps this is a case where I should call him "dad," for I saw that a writer recently stated: "When father has money we call him 'father.' When he takes the collection at church, we call him 'Papa.' If he goes shopping with mother and pushes the 'pram', we call him 'Pa.' But if he buys us Meccano, and gives us a hand with the models till his fingers ache from screwing up the bolts with them, instead of using a screwdriver, we call him 'Dad!'"—So "dad" let it be in this case!) Send in your efforts before 31st March and mark your envelopes "Inventors." Overseas readers may have until 30th July for sending in their entries—a distant date certainly, but one that gives my young friends in the wilds of Australia and New Zealand a chance!

Wembley Figures

Those Meccano boys who paid a visit to Wembley (and also readers who were not so fortunate) will be interested in the figures that have just been published showing details of the food consumed at the world's greatest exhibition. The caterers state that sometimes they had to deal with as many as 300,000 people in one day, and that as there was no storage at Wembley everything had to be taken there fresh each day. In the course of a single week, visitors consumed 75 tons of meat, 260 tons of bread, 40 tons of potatoes, 5 tons of tea, 300,000 tins of sardines, 500,000 bottles of mineral waters, and 2,000,000 small cakes! Over 2,000,000 meals were served each week, and the caterers provision vans made 70 journeys a day between Wembley and London. We are better able to imagine the amount of crockery that was required when we learn that the breakages during the exhibition included 450,000 tea-pots, 1,378,000 cups, 410,000 saucers, and 1,480,000 glasses! The same firm is not undertaking the catering this year.

Contributions Wanted

I am at all times pleased to consider articles, photographs, and sketches for publication in the "*M.M.*" Many articles are sent to me from time to time, but many of these are unsuitable. They are either too "high-brow," or, on the other hand, not of sufficient general interest to the majority of my readers to enable me to print them. For instance, although interesting to me personally, a description of your pet rabbit, an article about your garden, or an account of what you did last Saturday afternoon, are not of sufficient general interest to 100,000 readers to warrant my publishing them in these pages. I like to hear from you all about these things in your happy letters to me, but the articles that I want for publication are those that deal with any new engineering structure in your district, anything connected with Meccano—such as some new application or some particularly interesting movement—articles on railways, locos, electricity, Radio and similar subjects. These will all be welcome—the more so if your articles are typed or neatly written on one side of the paper only. In each case your name and address should be clearly shown—this is a necessary remark because it is surprising how often contributors forget these important details and then write a strong letter asking me why the contribution has not been acknowledged or returned! Payment will be made at our usual rates for those articles that are published. One other point: All articles and sketches submitted should be original, that is, they must not be copied from or modelled on an article that has already been published, as the author of the original article has the copyright of it, and it is illegal to "lift" it, either as a whole or in part, without his permission. This also applies to articles published in the "*M.M.*," of course, and if your article is accepted it is copyright, and cannot be reprinted by any other magazine without permission. Wherever possible I am always pleased to give permission for articles to be reprinted in other magazines—whether they are regular magazines or Meccano Club magazines—but articles must not be lifted from the "*M.M.*" without this permission.

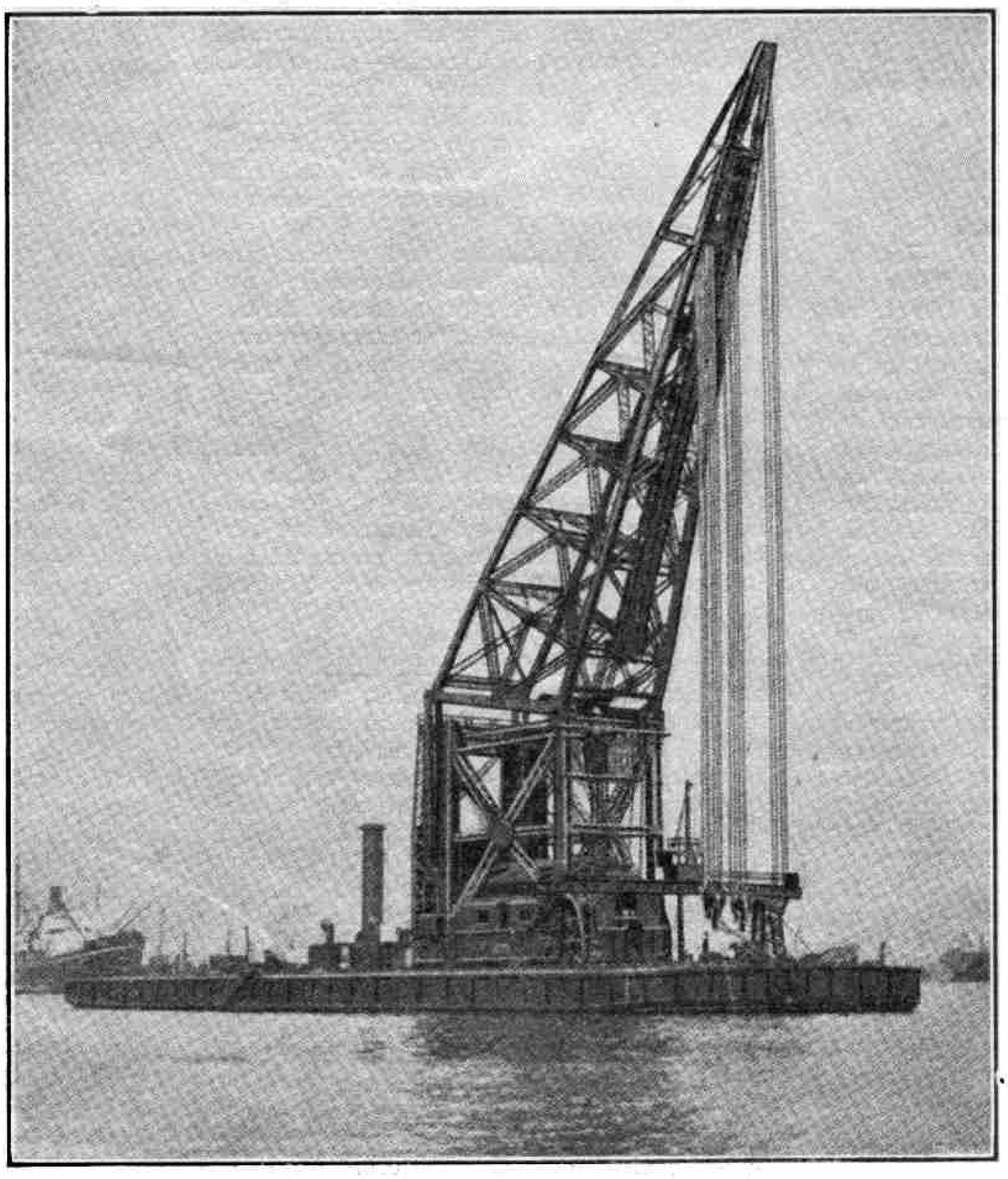
The Largest Floating Crane in the World

A 350-Ton Giant for Japan

THERE is no more interesting member of the large family of giant cranes than the self-propelled floating crane. Whereas the larger land cranes have a very limited radius of movement, the floating crane is able to steam slowly and majestically to any part of a harbour or dockyard and take up the best position from which to tackle the work to be done. This freedom of movement makes the floating crane of the greatest possible value in the construction of the huge battleships and passenger and cargo liners of the present day, and indeed it is doubtful whether these monster vessels could be built and equipped without the aid of such cranes. Their value is also very great in various operations of ship repairing.

Floating Giants

Many giant floating cranes have been built during recent years for various naval dockyards, great ship-building firms and harbour authorities. Those Meccano boys who have been regular readers of the *"M.M."* from its early days may remember that in the September — October issue, 1921, we illustrated and described an immense crane of this type belonging to the British Admiralty. This crane was designed to lift a load of 250 tons over a radius of 100 ft. and to a height of 77 ft. 6 in. above the level of the water. On test, however, it proved capable of lifting 312 tons. The proportions of this crane were so well designed and its weight was so well distributed that even when the crane-arm was lifted to its greatest extent without a load, and at its minimum reach athwart-ships, the deck was inclined only four degrees in a direction of depression on the side behind the elbow. Another crane of very similar capacity was built in 1923 for the United States Navy department. An unusual feature about this crane is that it is built on to the hull of an old battleship.

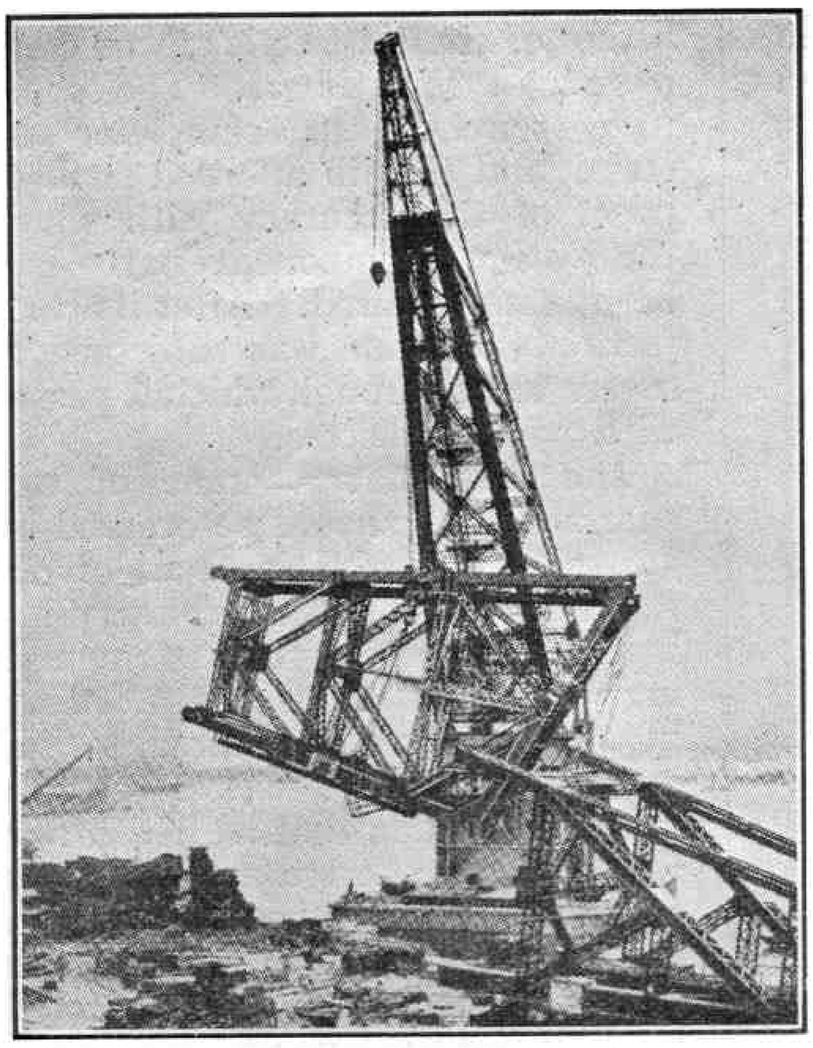


Completed Crane with Jib fully raised

The Mersey "Mammoth"

Another interesting floating crane is the "Mammoth," belonging to the Mersey Docks and Harbour Board. This crane is capable of handling loads up to 200 tons. It is of the derricking-jib type, and is able to deal with heavy loads over the gates of large graving docks, which is a very valuable asset, particularly in ship repair. It is also capable of lying alongside the largest vessels and delivering loads up to 60 tons from the hold of the vessel direct on to the quay. This crane was built in Holland, and on a trial trip on the River Meuse it was shown that its two sets of triple-expansion marine type engine were capable of propelling it at an average speed of nearly five miles per hour. It is interesting to know that the crane was towed from Schiedam to Liverpool without the jib being dismantled.

One of the most interesting feats accomplished by the "Mammoth" was the transporting of a lock gate across the Mersey. The gate was removed from the Alfred Dock, Birkenhead, to the Brunswick Dock, Liverpool, in three sections, for strengthening and various repairs. The necessary work was carried out, and half of the gate, weighing approximately 190 tons, was transferred by the "Mammoth" back to the Alfred Dock. Later the "Mammoth" successfully transferred the second half of the gate



Lifting Lower Section of Jib

without any difficulty. On each occasion the crane raised the half gate from the dock wall and swung it on to her own deck where it rested vertically in an improvised cradle. The crane was towed across the river by a pair of tugs with a third tug astern. Another feat of the "Mammoth" was that of lifting into position a bridge section weighing 152 tons at New Brighton Ferry.

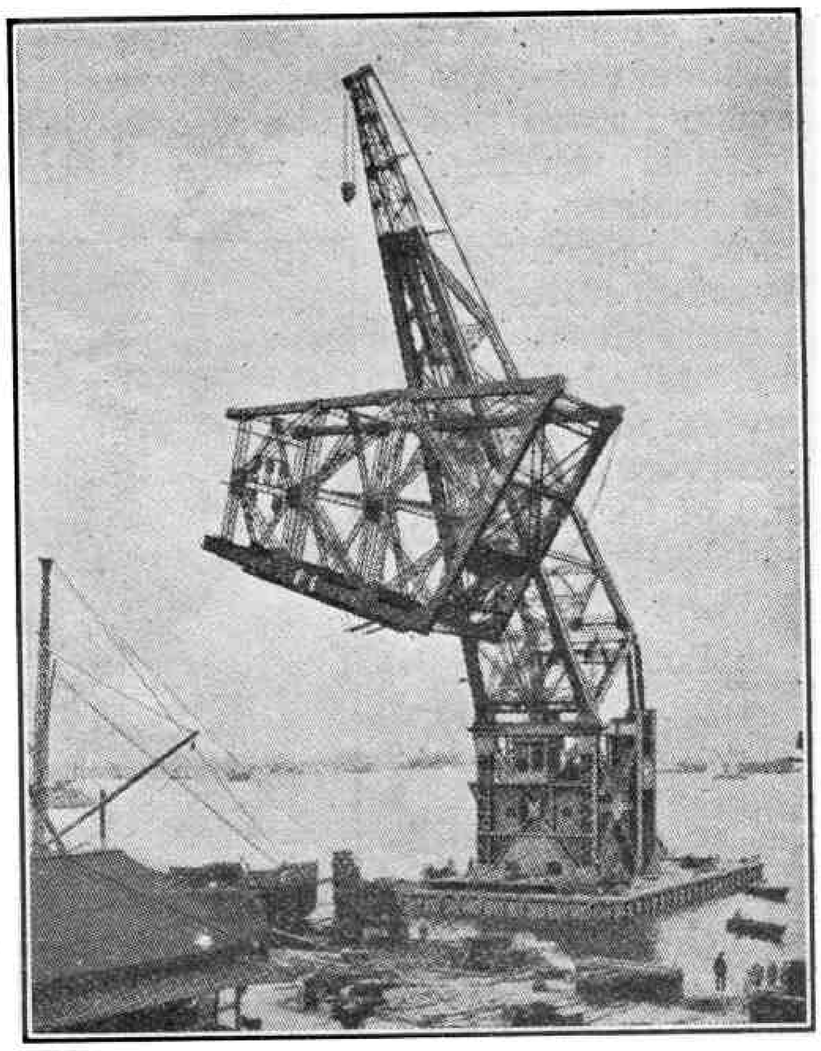
Monster to Lift 350 Tons

The increasing tonnage of modern vessels has led to a corresponding growth in the size of cranes, and last year Messrs. Cowans, Sheldon & Co. Ltd., of Carlisle, designed and built for a Japanese shipyard the floating crane shown in our illustrations. This monster is capable of lifting no less than 350 tons. It was partially erected in the builders' works at Carlisle, and was finally erected in Japan under the supervision of one of the builders' engineers. The Japanese firm to whose order the crane was built, Mitsubishi Shoji Kaisha Ltd., themselves constructed the pontoon and propelling machinery to plans prepared for Messrs. Cowans, Sheldon & Co. Ltd., by Sir W. G. Armstrong, Whitworth & Co. Ltd., of Newcastle-on-Tyne.

Main and Auxiliary Lifting Gears

The following details of this crane, for which we are indebted to "*The Engineer*," give some idea of its vast size and power. It is capable of lifting and revolving through a complete circle with loads up to 350 tons at 100 ft. radius, or 300 tons at 121 ft. radius. It can lift either of these loads through a vertical distance of 140 ft. The main loads are lifted on two independent blocks, each of 175 tons capacity, the operating machinery being arranged so that these blocks may be used either coupled together or independently as desired.

An auxiliary purchase of 50 tons capacity is provided at the end of the jib at a distance of about 40 ft. in front of the main purchase, and this block is arranged for a vertical lift of 200 ft. There is also another purchase of 50 tons capacity. This is carried on a trolley that travels along the underside of the jib to a sufficient extent to move the load through a distance of about 75 ft. measured horizontally. This feature enables the crane to deal with comparatively small loads at high speed without any necessity for using the derricking motion.



Jib in mid-air

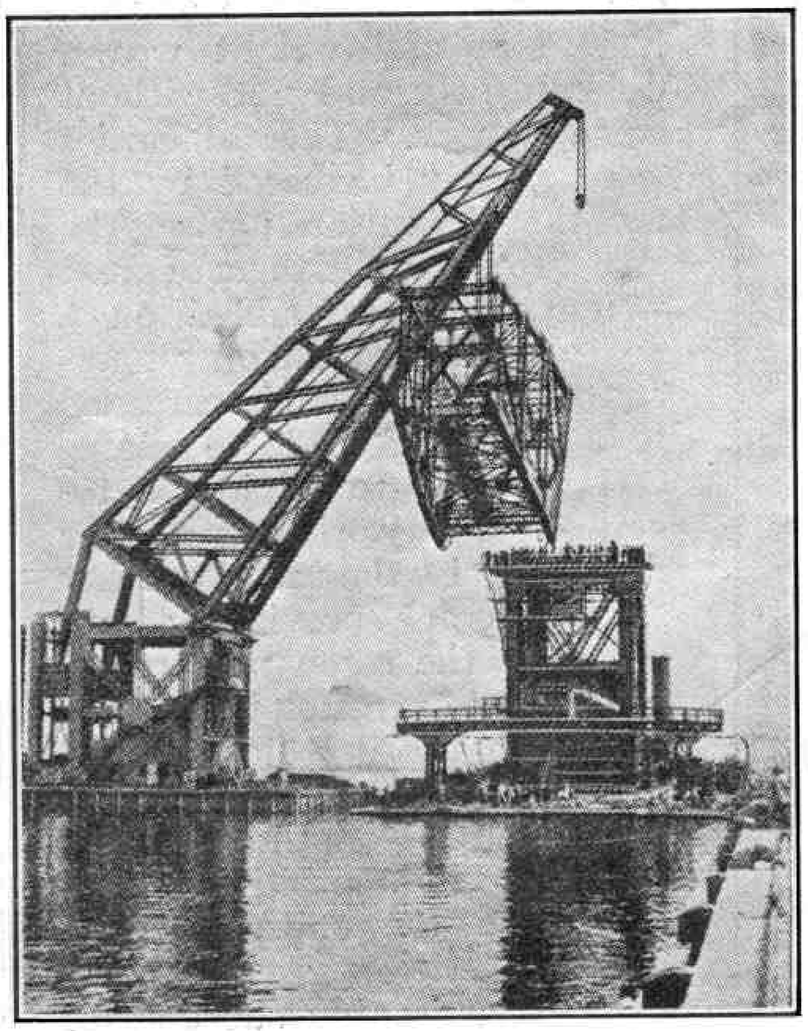
Nine Sets of Engines

The jib is capable of derricking in from the maximum radius of 121 ft. to a minimum radius of 50 ft., and when in this position the overall height to the top of the crane is 240 ft. The whole crane is mounted on a roller path having a diameter of 50 ft., and fitted with special machinery that enables the crane to be revolved with its load through a complete circle in either direction.

Each individual motion is operated by an independent set of double-cylinder engines. These are fitted with link motion reversing gear, and altogether there are nine such sets of engines.

The jib is raised and lowered by means of two steel screws 49 ft. in length and 14 in. in diameter, placed at the back of the crane and driven from the engines through a train of gearing.

The superstructure consists mainly of a rectangular braced frame supporting the jib and carrying the guides for the cross-head. It is 66 ft. in height, measured from the roller path to the jib foot pivot. The whole of this portion of the crane had to be designed with the greatest possible care because of the various forces it had to withstand—these being much greater, indeed, than in any previous floating crane.



Jib swung round ready for Lowering

Hydraulic Brakes

The main and auxiliary lifting gears are each fitted with specially-designed hydraulic brakes to control the lowering of the loads. These brakes are powerful enough to enable any load to be sustained with safety or lowered with pre-

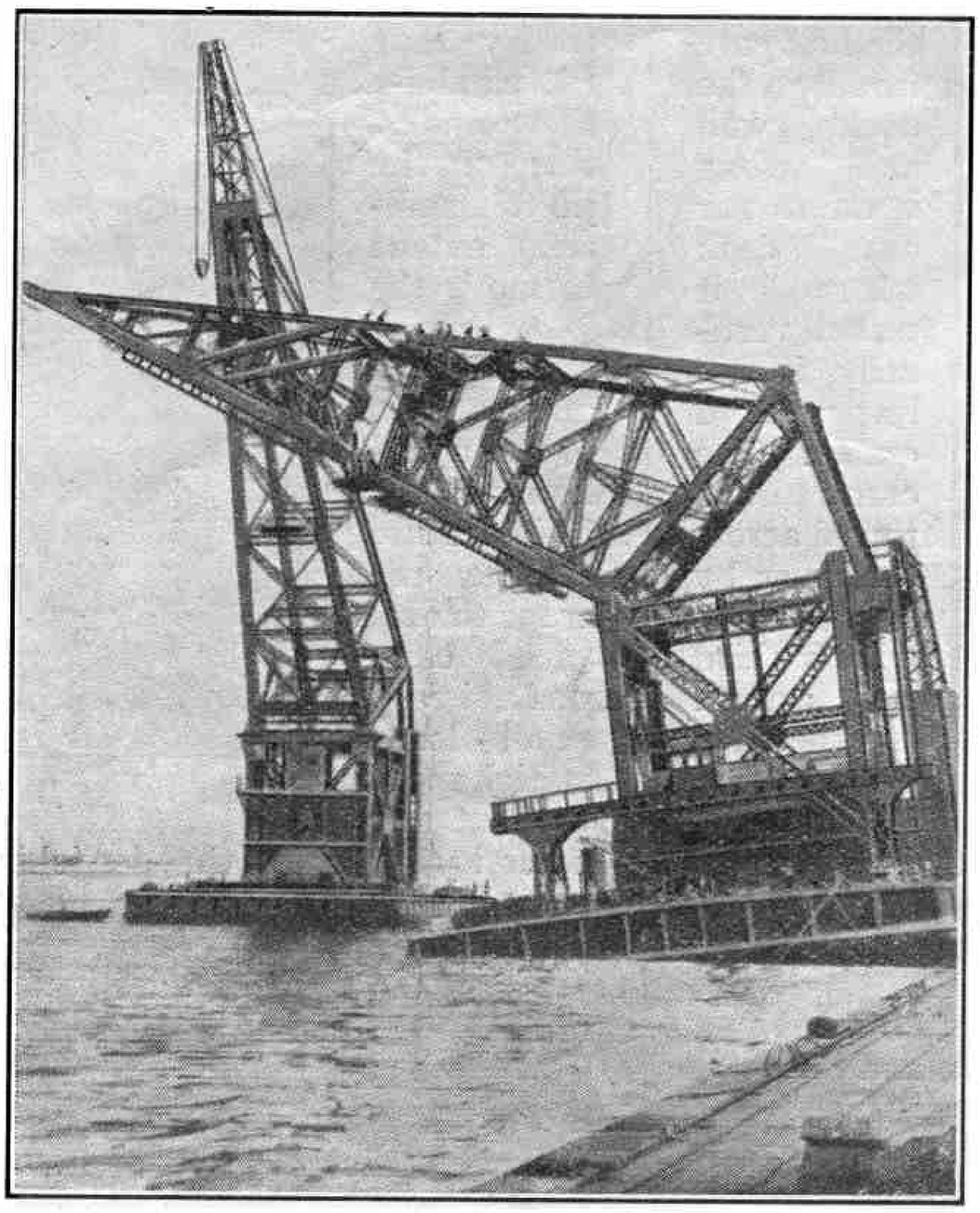
cision at any space between the maximum and the lowest possible creeping speed that may be used in practical working. The whole of the motions of the crane are controlled by one operator from a cabin situated immediately below the jib foot and giving a clear view of the load and of the site over which the crane is working.

The Pontoon

The pontoon itself is 270 ft. in length and 92 ft. in width, with a draught of about 10 ft. Its size is such as to render unnecessary any moving or water ballast which usually has to be adjusted by the operator.

Behind the crane a large portion of the deck area is arranged so that it is possible to carry a deck load of some 700 tons. The propelling machinery, which is placed amidships, consists of twin-screw compound engines supplied with steam from two single-ended boilers at a pressure of 150 lb. per square inch.

The hull is built entirely of steel, and is divided by bulkheads into water-tight compartments. The deck equipment includes a steam windlass, steam capstans, steam and hand-steering gear, davits, lifeboats, and all the accessories necessary for a sea-going vessel. The ship is navigated from a steel bridge extending the full width of the deck and situated immediately in front of the crane base.

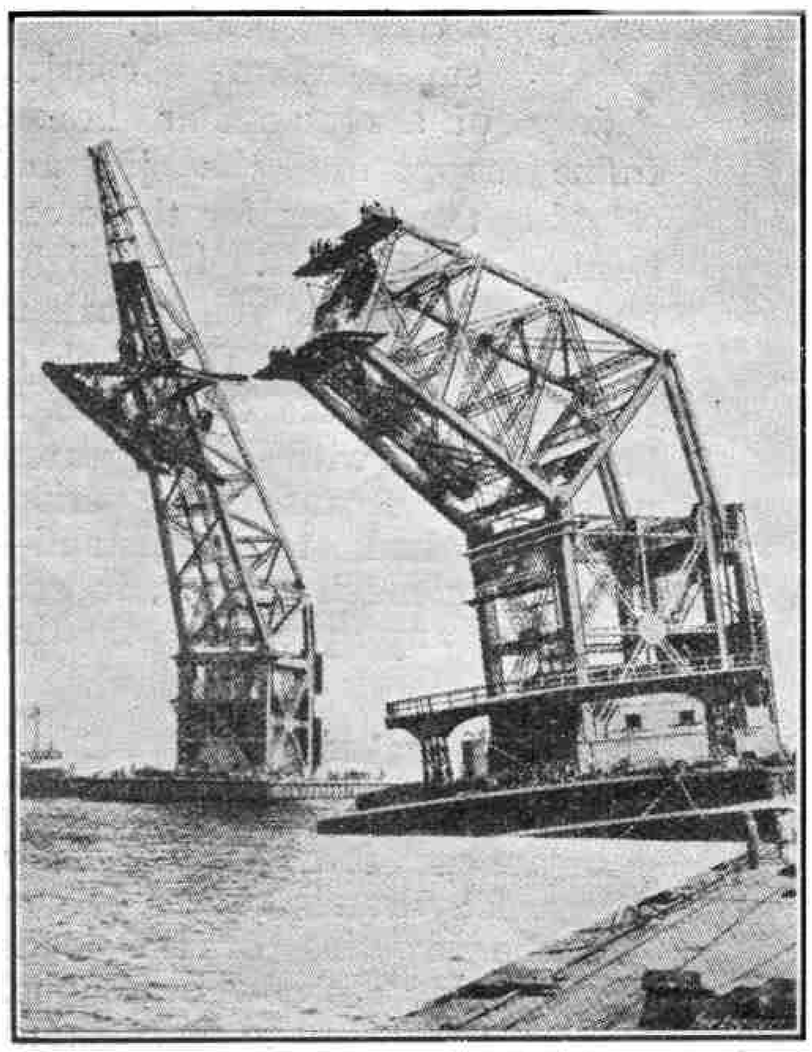


Jib in Position

Erecting the Crane

As may be imagined, the erection of a structure of such huge size and weight was a difficult task and not without some danger. The difficulties were greatly increased by the fact that the various parts of the structure, many of them of great weight, were assembled on a floating base, which, on numerous occasions, had to be careened to a sufficient angle to enable certain parts to be joined together. The work was greatly facilitated by the use of another floating crane previously supplied by the same makers.

The first operation in the task of erecting the jib, which weighed over 300 tons, was to lift the lower section from the quay side and place it in position for securing to the superstructure. This operation was carried out in the remarkably short space of six hours. The next task, the lifting of the top section, was completed in four hours. The short time required to complete the erection of the jib afforded striking proof of the accuracy with which the various component parts had been manufactured. After its completion the crane was subjected to severe tests, through which it passed with perfect success.



Attaching upper section of Jib

The fact that a crane of this enormous size should be ordered by Japan is a notable instance of the rapid strides that that country has made during recent years in engineering work of all kinds, and not least in the building of warships and merchant vessels. It is also a matter for pride that a British firm was chosen to design and build this crane, and that when the various sections of it reached Japan after their long journey, and were erected, the gigantic machine worked exactly in the perfect manner aimed at by its designers.

(The photographs illustrating this article are reproduced by courtesy of "The Engineer.")

Wireless Aids Fishing Industry

Wireless seems destined to work something like a revolution in the fishing industry. The movements of fish are notoriously irregular and uncertain. For no apparent reason large shoals of fish will suddenly leave one part of the sea, where previously they have abounded, and travel to another part where before there was hardly a fish to be caught. Before the coming of wireless there was no means of quickly reporting these changes of fishing ground, and consequently, while one trawler might find herself in the midst of an enormous shoal, another might have absolutely no luck at all. To-day, many of the larger trawlers are fitted with wireless, so that reports of shoals of fish may be promptly transmitted from one vessel to another. At the same time such trawlers can communicate promptly with their owners in case of need.

Possibly in years to come every large trawler will be fitted with wireless, and in that case we should hear fewer of the sad stories of fine vessels leaving Hull or Grimsby for Iceland waters and never being seen or heard of again. There is no doubt that the crew of many a trawler might have been saved if a wireless call for help could have been sent out over the raging seas.

Receiver with Five Crystals

The would-be purchaser of wireless sets or accessories nowadays finds himself in the midst of such an embarrassment of riches that he has difficulty in making his final selection. The crystal detector, whether used alone or as the foundation of a valve set, is now more popular than ever as the result of the establishment of so many relay stations. The Service Radio Co. Ltd. (67, Church Street, Stoke Newington, London, N.16), lists a series of crystal detectors that should meet every possible requirement. In particular may be mentioned a "multi-crystal" device by means of which any one of five different crystals can be brought into adjustment immediately as required by the turn of a small handle. This firm also supplies excellent single-valve and two-valve amplifiers to increase the strength of reception, the two-valve amplifier making possible the use of a loud speaker. Yet another ingenious appliance is a "multiphone" arrangement that enables several pairs of telephones to be readily connected to one receiver.

"Flying Scotsman" at Work Again

Famous Wembley Exhibit Returns to Duty

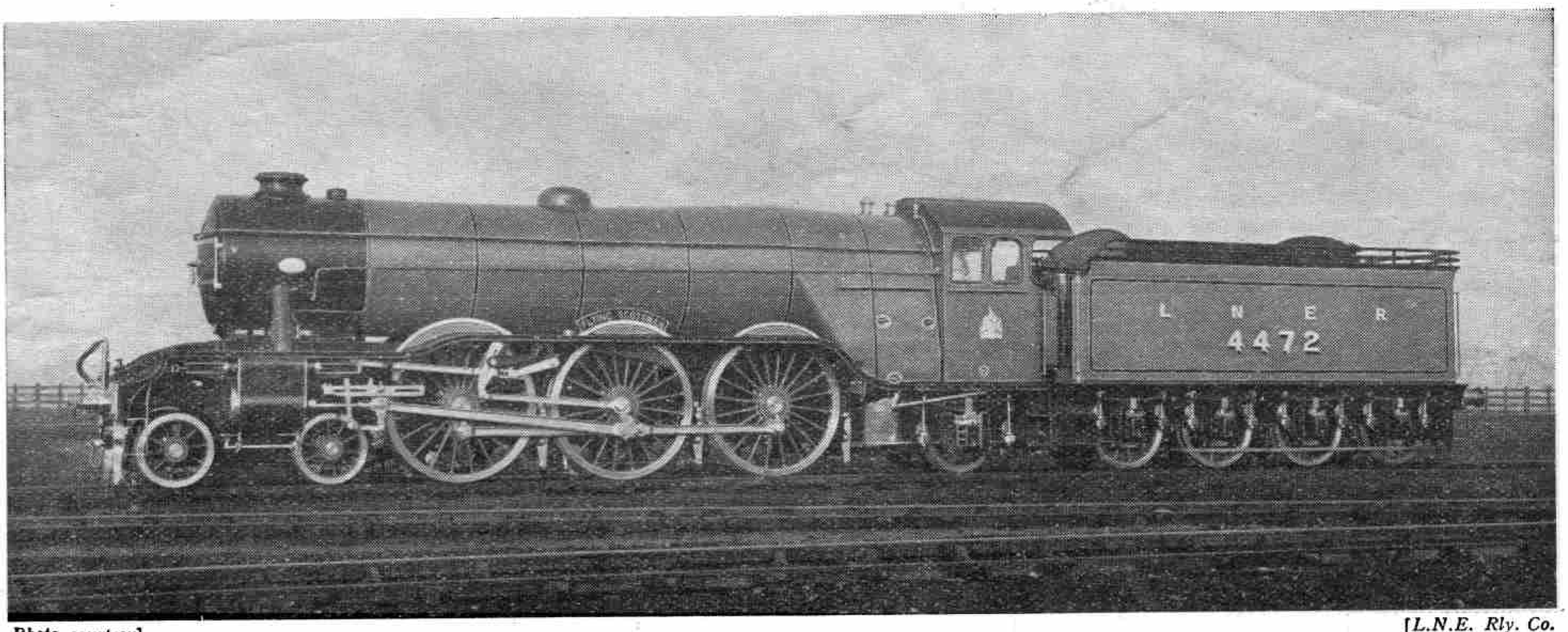


Photo courtesy] [*L.N.E. Rly. Co.*

After a long rest at Wembley, this fine L.N.E.R. Three-Cylinder Express Passenger locomotive, the "Flying Scotsman," is back at work again, hauling its heavy loads every day between London and Edinburgh

LAST month we described the rolling-stock of the new "*Flying Scotsman*," claimed to be the most comfortable and luxurious train in the world for passengers paying ordinary fares. Our description of this train would not be complete unless we included some mention of the splendid locomotives that haul it to and from Scotland every day. We illustrate on this page one of the finest, and incidentally the largest, locos in Great Britain. This loco, No. 4472, bears the same name as the train it pulls, and it must be familiar to a large number of our readers. Indeed, many who read these pages have climbed up into the cab of the loco., as it stood silent and dignified in the Palace of Engineering at Wembley. Now it is busy again with its daily task of carrying hundreds of passengers between London and Edinburgh.

Driving Wheels 6 ft. 8 in. diameter

No. 4472 is indeed a handsome piece of mechanism, and no doubt the impression of great power that the design conveys is further increased by the fact that the crown of the fire-box slopes upwards from the cab, while the first part of the boiler drops slightly from the fire-box towards the smoke-box. This brings the smoke-stack in line with the top of the cab, 13 ft. 4 in. from rail level, resulting in a very graceful outline.

As most of our readers know, the "*Flying Scotsman*" belongs to the now famous fleet of the "Pacific" type locomotives (4–6–2), owned by the London & North Eastern Railway Company. Its number denotes that it belongs to the section that was known before the amalgamation as the Great Northern Railway. We may mention in passing that the locomotives of the respective constituent groups of the L.N.E.R. are indicated by their numbers—N.E.R.–1–3,000; G.N.R.–3,001–5,000; G.C.R. and G.N.S.R.–5,001–7,000; G.E.R.–7,001–9,000; N.B.R.–9,001–11,000. The "*Flying Scotsman*" is fitted with a super-heater having a heating surface of 525 sq. ft. which brings the total heating surface, including the 168 boiler-tubes, firebox, etc., to 3,455 sq. ft.

In working-order the engine with tender weighs 148 tons 15 cwt. The steam working-pressure is 180 lbs. per sq. in., and there are three cylinders, each 20 by 26 in. and each driving the centre pair of coupled wheels.

The diameter of the wheels of the leading bogie is 38 in., of the coupled drivers 80 in., and of the trailing wheels 44 in. The 8-wheeled tender carries 8 tons of coal and 5,000 gallons of water.

The locomotive was built to the designs of Mr. H. N. Gresley, Chief Mechanical Engineer to the Company, and has proved very successful; indeed, large numbers of the same type are now in course of erection.

"Atlantic" Locos Outclassed

Although the London & North Eastern Railway did not employ "Pacific" locomotives earlier than 1922, the type has been recognised since 1908. In that year the Great Western Railway introduced the first "Pacific" locomotive in this country in the form of the "Great Bear," which locomotive was described and illustrated in our issue of January 1923.

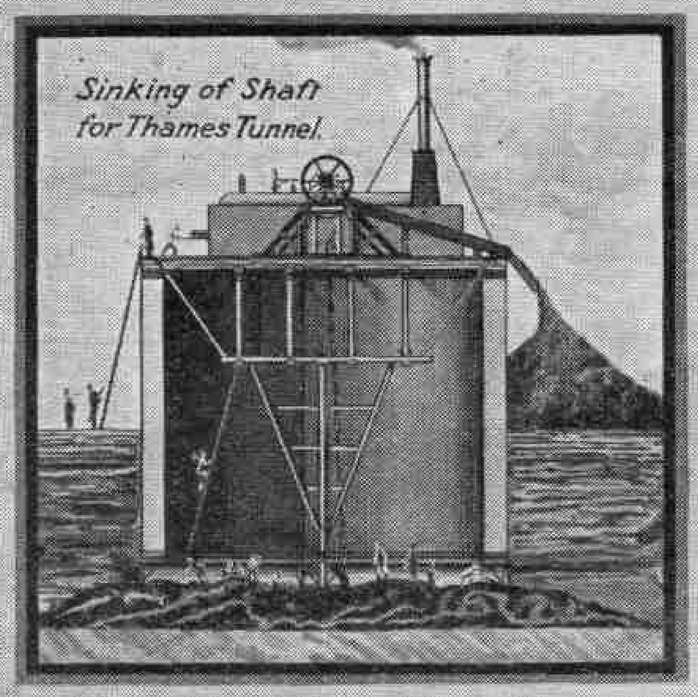
The term "Pacific" was coined for the 4–6–2 class from the fact that the type was first exploited in that part of the British Empire set in the Pacific Ocean, principally in New Zealand and West Australia, and was singularly appropriate in that it followed the earlier "Atlantic" class, or 4–4–2, originating on the Philadelphia-Atlantic City line in America.

The evolution of the "Pacific" has been very rapid indeed since those days. From the point of view of speed and strength it has proved very satisfactory, and the locos. of this type have entirely outclassed the "Atlantics" in the race to keep pace with the requirements of modern railway traffic. With but few exceptions, the "Pacifics" are now recognised as the standard type for express passenger locomotives the world over.

American "Pacifics"

In the United States and Canada, "Pacifics" are used to haul some of the heaviest express trains over considerable distances, including many exceptionally steep gradients. The "Pacifics" recently built for the Philadelphia and Reading Railroad work fast passenger trains, which often exceed 600 tons in weight, at an average speed of 60 miles per hour over the shorter routes. These locos have boilers of the Belpaire wide fire-box type, equipped with 436 tubes and superheater. The cylinders measure 27 in. by 28 in. and are supplied with steam at a pressure of 205 lbs. per sq. in. The locomotive with tender weighs 467,890 lbs. in working order and exerts a tractive effort of 44,460 lbs.

It is difficult to say whether future railway conditions in this country will necessitate the construction of even more powerful locomotives—and consequently with greater wheelbases—but at present the 4–6–2 arrangement seems to meet the most exacting requirements of passenger traffic.



Lives of Famous Engineers

XIV M.I.BRUNEL CONSTRUCTS THAMES TUNNEL

In our last article we saw something of the earlier work of Sir Marc Isambard Brunel and we learned how his keen brain was continually seeking to substitute machinery for hand labour in every possible direction. This month we are to consider the greatest of his many achievements—the construction of the Thames Tunnel. Our subsequent articles will deal with the great achievements of I. K. Brunel, including the Great Western Railway and that impracticable monster "The Great Eastern," a steamship, which—as we shall see—was many years in advance of her time.

THE original idea of uniting the counties of Kent and Essex by a tunnel beneath the Thames is generally attributed to a Mr. Dodd, who wrote a report on the matter in 1798. Dodd proposed to tunnel the river between Gravesend and Tilbury, the total distance of the tunnel to be 900 yards.

Early Attempt Fails

In 1802 a Mr. Vazie put forward a suggestion for a tunnel from Rotherhithe to Limehouse, and a company was formed to further the project. In order to explore the ground it was considered necessary that a drift-way should be constructed, which later should form the drain to the tunnel itself. A shaft 11 ft. in diameter was accordingly sunk to a depth of 42 ft.

Shortly afterwards, owing to the foolish policy of the directors in substituting an imperfect steam engine of very much less horse power than had been demanded by the engineer, water broke in and it was with the utmost difficulty that work could be proceeded with.

For some time the directors hesitated as to whether to continue the work or abandon it, and ultimately Vazie was removed from his position as engineer and superseded by Trevithick. Work on the drift-way was resumed, at first with success, but later the bed of the river gave way and water again inundated the drift. The hole was filled up by throwing into it clay in bags and work was resumed, but shortly afterwards the roof gave way a second time. Sand and water rushed into the drift-way with such violence that in a few minutes the water rose almost to the top of the shaft. Once more the hole was filled and work recommenced, but ultimately the bursts of water became so frequent and unmanageable that the work was abandoned.

Brunel's Proposals

About this time Brunel's attention was drawn to the question. The first reference to the tunnel in his diary is dated 12th February, 1823. From then onwards the entries became more and more frequent, showing that the matter was gradually absorbing the whole of his attention. By the close of the year he had so far matured his designs, and had enlisted so much support from various influential persons, that a public meeting was called for the purpose of forming a company. The first general meeting of the company was held on 18th February, 1824, and about a month later the Bill for the incorporation of the company, having passed without opposition through both Houses of Parliament, received the Royal Assent.

Brunel was appointed engineer to the company at a salary of £1,000 per annum for three years, the utmost limit that the directors contemplated as necessary for the completion of the work.

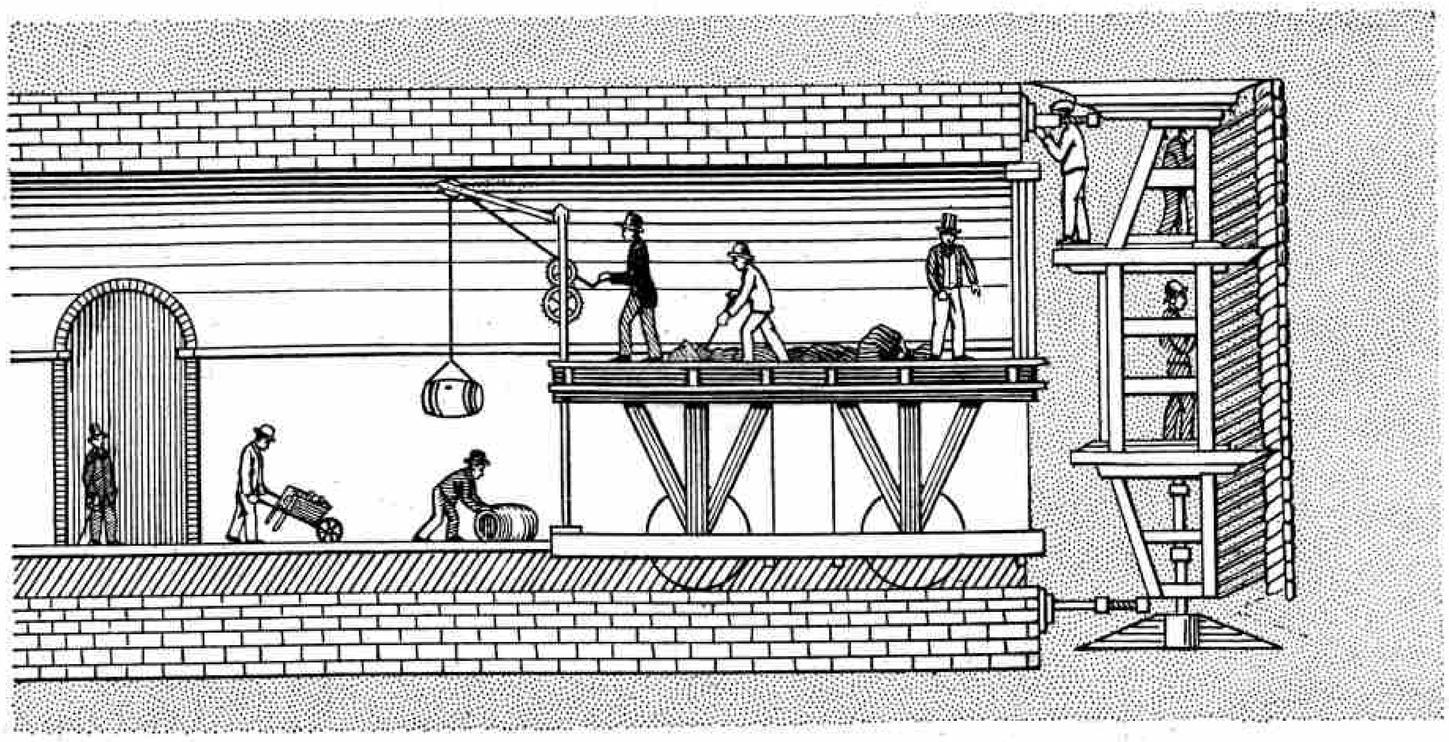
Sinking the First Shaft

On 16th February, 1825, the ground for a distance of about 140 ft. from the river wharf at Rotherhithe was cleared for the construction of a shaft 50 ft. in diameter. The brickwork to form the lining of the shaft was built on the surface of the ground, and as the earth was excavated from within and beneath the structure, it gradually sank to its final position. The brickwork was 3 ft. thick and was bound together by iron and timber ties. Built into it were 48 perpendicular iron rods 1 in. in diameter, bolted to a wooden curb at the bottom of the wall and to another curb at the top. When the brickwork shaft was completed to its height of 42 ft., the blockings on which it rested were removed, the gravel was excavated and hoisted up, and the shaft descended by its own weight.

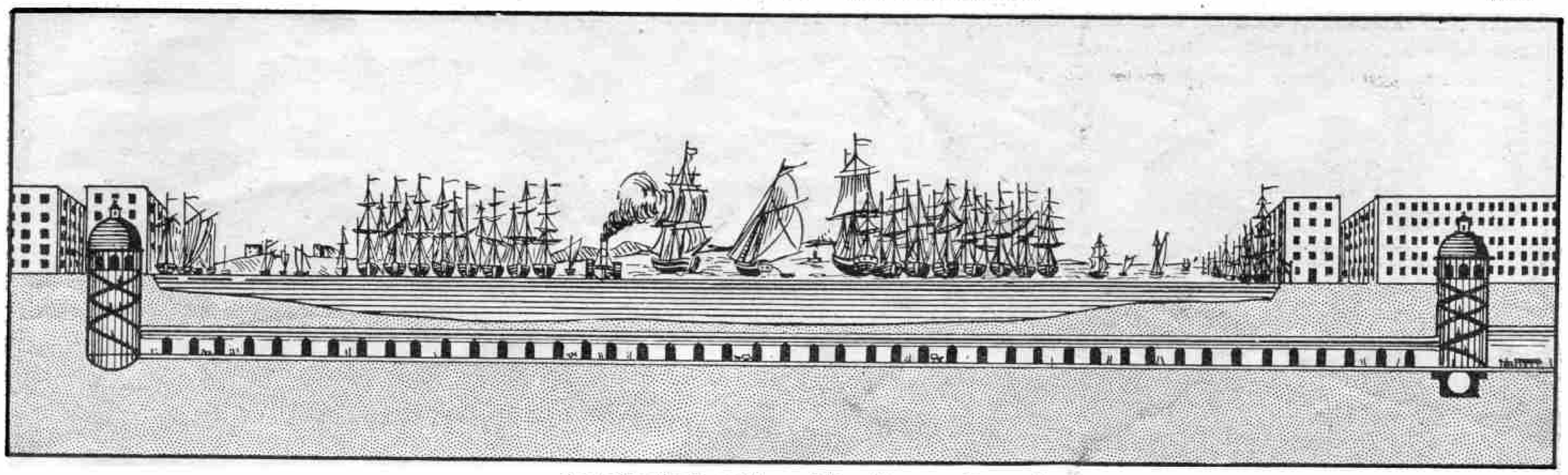
The shaft was sunk 40 ft. in this manner, the remaining 20 ft. being constructed by under-pinning, in order to leave the opening for the tunnel. This was completed on 11th August, and preparations were then made for constructing a reservoir at the bottom of the shaft for receiving the permanent pumps. The reservoir was completed on 11th October, and the hole was closed by a dome, an opening being left for the four pumps and for examination.

Ship-worm Suggests Idea of Shield

During these operations the great shield, by means of which the tunnel was to be driven, was being constructed by Maudslay. On 15th October, 1825, two of the twelve frames of which the shield was



Section showing shield, propelling screws and movable stage



Longitudinal section of the Thames Tunnel

composed were lowered into the shaft and placed in position. As this remarkable shield was a most valuable invention we must turn our attention to it, so that we may understand the important part it played in this particular work.

One day Brunel was passing through the dockyard at Chatham, when his attention was attracted to an old piece of ship timber that had been perforated by that well-known destroyer of timber, the *Teredo navalis* or "ship-worm." He examined the perforations, and subsequently the animal itself, with the greatest interest. He found the animal armed with a pair of strong and hard valves to which, by using its foot as a fulcrum, it was able to give a rotary motion by a set of powerful muscles. These valves then acted on the wood in a similar manner to an auger and slowly but surely penetrated it, no matter how hard it might be. As the particles of excavated wood were removed they were passed through a longitudinal fissure in the worm's foot, which formed a canal to the mouth.

From the action of this animal Brunel conceived the idea of a shield of iron, with auger-like cells for the miners. His idea was that the shield would be forced forward with a rotary motion by hydraulic presses, displacing only as much ground as the shield would occupy in its place. In 1818, he took out a patent for this machine, which subsequently became one of the most famous of his inventions.

Construction of the Shield

The shield employed in excavating the Thames Tunnel consisted or twelve independent structures or frames made of cast and wrought iron, each 22 ft. in height and a little over 3 ft. in width. These frames were placed side by side against the face of the excavation, occupying its whole area, and also the top, bottom and sides for 9 ft. in advance of the brickwork, which was completed close up behind the shield as it advanced.

Each frame stood on two feet, which rested on the ground, and each frame was divided vertically into three cells by means of cast iron floors. In each of the 36 cells thus provided, a miner stood and worked at the material in front of him.

The sketch on page 110 will give some idea of the construction of one of these frames. On the right, pressing against the ground to be excavated, were "poling boards" held in place by "poling screws" resting against the cast iron frames. The poling boards were 3 ft. in length, 6 in. in width, and 3 in. thick and were arranged horizontally. There were more than 500 of them, and they covered the whole surface in front of the frames.

Method of Working

The method of working was as follows: Standing in their cells the miners took down one, or at the most two of the poling boards, beginning at the top of the cell, excavated the earth a few inches and then replaced the poling boards, pressing them against the new face by means of the poling screws. In this manner the excavation was carried out without depriving the ground of support except at the point at which the miners were actually at work.

When everything was ready for a move, the frames were pushed forward by means of large hydraulic screws, one at the top and the other at the bottom, abutting against the brickwork of the tunnel. A movable stage immediately behind the shield to receive the building materials for the upper portion of the work was also utilised, as shown in the drawing.

The Tunnel Commenced

On 28th October the 12 frames were in place, but the fitting and adjusting of the parts, and the construction of the entrance to the tunnel, occupied some time, and it was not until a month later that the shield commenced to move forward.

Steady progress was made from this time, in spite of very serious difficulties resulting from the inrush of water and from the variable nature of the ground encountered. The work was mainly superintended by Brunel's son, I. K. Brunel, whose energy and keen intelligence were of the greatest value to his father.

To describe in detail the various little mishaps that occurred from day to day, and the methods employed to counteract them, would soon become very monotonous even to our keenest reader. We will therefore content ourselves with saying that the shield pushed its way steadily forward without any very serious mishap throughout 1826 and up to the May of the following year, when the first serious irruption of the river occurred.

First Irruption of River

During the early days of this month work became more and more difficult and dangerous. On the 18th a party of visitors inspected the shield and the workings about 5 o'clock in the evening, and although this visit caused great anxiety to those in charge, it was concluded without mishap. Scarcely had the party left, however, than disaster occurred. A miner in one of the frames suddenly called for assistance and another miner was ordered to go to him at once. Before he could do so, however, there poured in such an overwhelming rush of slush and water that the men were driven out.

Of the subsequent happenings, Mr. R. Beamish, in his life of Sir M. I. Brunel, gives the following account:

"I made an effort to re-enter the frames calling upon the miners to follow; but I was only answered by a roar of water, which long continued to resound in my ears. Finding that no gravel appeared, I saw that the case was hopeless. To get all the men out of the shield was now my anxiety. . . . . On we sped. . . . . At the bottom of the shaft we met Isambard Brunel and Mr. Gravatt. . . . . We turned. . . . . The spectacle that presented itself will not readily be forgotten. The water came on in a great wave, everything on its surface becoming more distinctly visible as the light from the gas-lamps was more strongly reflected. Presently a loud crash was heard. A small office, which had been erected under the arch about 100 ft. from the frames, had burst. The pent-up air rushed out; the lights were suddenly extinguished and the noble work which, only a few short hours before, had commanded the homage of an admiring public, was consigned to darkness and solitude.

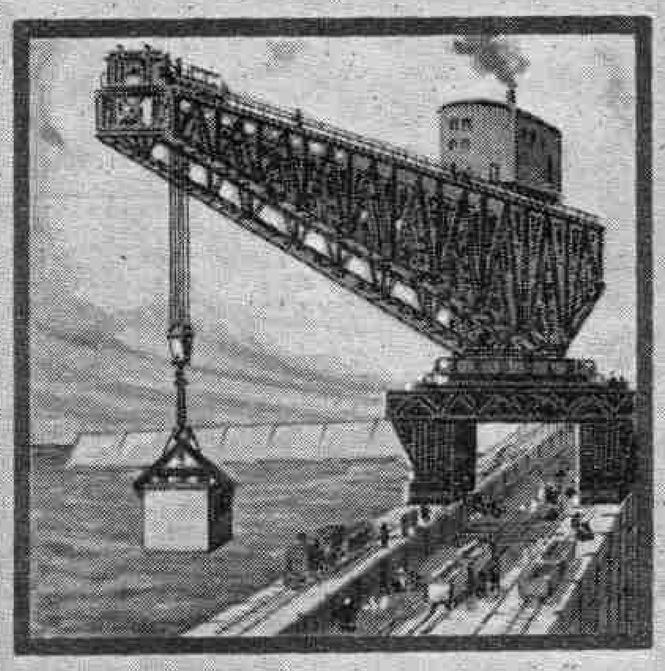
A Brave Rescue

"It only remained to ascend the shaft, but this was not so easy. The men filled the staircase; being themselves out of danger, they entirely forgot the situation of their comrades below. For the first time I now felt something like fear, as I dreaded the recoil of the wave from the circular wall of the shaft, which, if it had caught us, would inevitably have swept us back under the arch. With the utmost difficulty the lowest flight of steps was cleared, when, as I had apprehended, the recoil came, and the water surged just under our feet."

Repairing the Damage

In order to ascertain the actual condition of the bed of the river an examination was made by means of a diving bell on the day following the irruption, and a hole was found extending from about the centre of the tunnel excavation to a considerable distance eastward. In some parts the sides were vertical and no gravel was found, even on the adjoining undisturbed bed of the river, thus confirming the observation of the local watermen that a dredged hole had been encountered.

(*Continued on page* 120)



Giant Block-Setting Cranes

Their Work in Constructing Harbours and Breakwaters

IN our previous instalments we have learned something of the different types of breakwaters and the useful purposes they serve. Last month, too, we saw something of the early history of Dover Harbour, and we mentioned that this has long been recognised as an important harbour, one reason being that it is the nearest point on the English coast to France. This month we describe in greater detail the construction of the great Admiralty Harbour at Dover, which work is one of the triumphs of modern engineering.

Government Builds Harbours

The construction of the breakwater at Dover is quite different from the construction of the mound breakwaters with which we have previously dealt. Such harbour works as those at Plymouth and the breakwater at Algiers, for instance, which were carried out in the early part of the last century, were breakwaters of the simplest type. They were, indeed, very similar to those that had been constructed in earlier times, except that they were, perhaps, more massive.

Until comparatively recent years very little attention was given to the subject, for harbours had not been thought necessary until such time as trade developed. Then it was that the requirements of our Navy and mercantile marine demanded greater consideration should be given to such matters. Public attention was very strongly drawn to the necessity for the construction of harbours of refuge on the coasts of Britain by a letter from the Duke of Wellington, written in 1842, which drew special attention to the unprotected and defenceless state of the shores of this country. Three years later the Government took measures to construct several harbours at important places on our coast, amongst which was included Dover. Incidentally, it may be mentioned that this decision led, as a matter of course, to the undertaking of similar work by foreign powers in various parts of the world. Shortly afterwards the construction of harbours in our Overseas dominions—at such ports as Table Bay, Madras, and Colombo—was planned and carried out.

The Discovery of Cement

In 1824 a discovery that was to have a far-reaching effect on harbour construction had been made by Joseph Aspdin, a Leeds bricklayer. Aspdin found that by mixing limestone with clay, he was able to make a cement that possessed considerable advantages over any other similar material then known. He had found the master secret that gave the world the very valuable constructional material known as "Portland Cement"—a name derived from the fact that the cement, when set, closely resembles the well-known building-stone quarried at Portland, in Dorsetshire. Cement is particularly useful for the construction of such engineering works as docks, harbours, railways, irrigation-works and the like. Combined with steel-girders, introduced to give greater strength to the structure, it is capable of almost endless development, and in this form is known as "ferro-concrete."

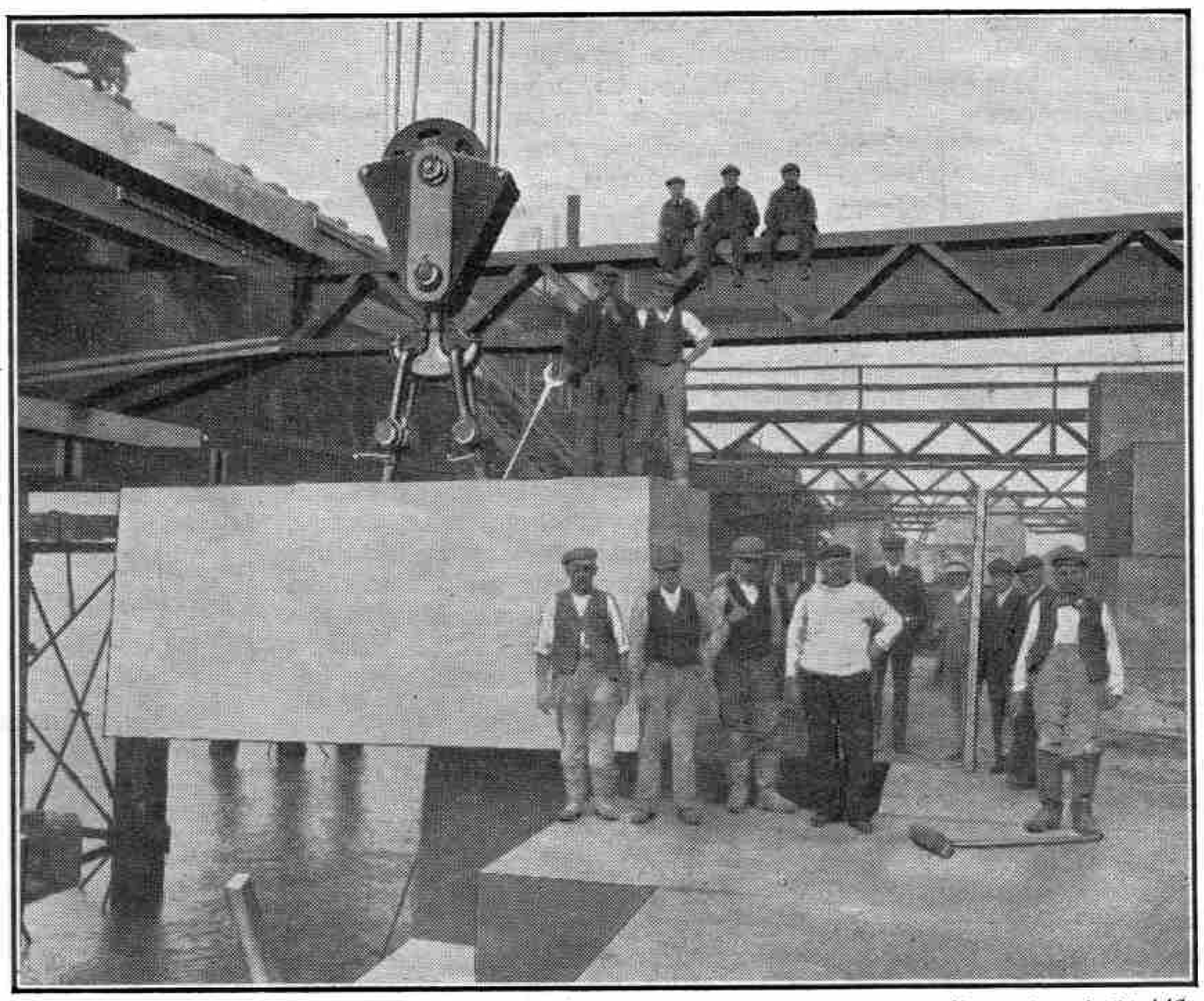
Concrete itself is no new discovery, for it was known to the Roman engineers. The domes and vaults of the baths of Ceracella and Dioceletian—amongst the chief sights of Rome to-day—are built of concrete, as is the huge dome of the Pantheon at Rome, one of the world's greatest buildings.

Although so many centuries have elapsed since these buildings were constructed they remain perfectly serviceable—indeed, many of them are probably in even better condition to-day than when first erected. It is believed that Portland Cement is even more serviceable and enduring than the concrete of the Romans, and in these circumstances it is not surprising to find that it is used so largely in the construction of harbour-works to-day.

Using the Diving Bell

If modern engineers had not adopted Portland Cement for this purpose, in place of the primitive form of breakwater construction, Dover Harbour—and many others of a similar type—could never have come into existence. The successful construction of these harbours was made possible practically entirely by the use of large concrete blocks, such as are illustrated on this page.

At Dover, blocks weighing over 40 tons were used. They were laid in layers (or "courses," as they are called) up to high water level and topped by a solid mass of concrete. Although the greater part of both sides of the breakwater is faced with granite, only the outer part is so faced, above low-water level on account of the great expense involved. The first or foundation course was laid on the carefully-levelled solid chalk. This operation, which required a long time and involved



Photo] [Messrs. Pearson & Sons Ltd.

Setting the Last Block at Dover Harbour

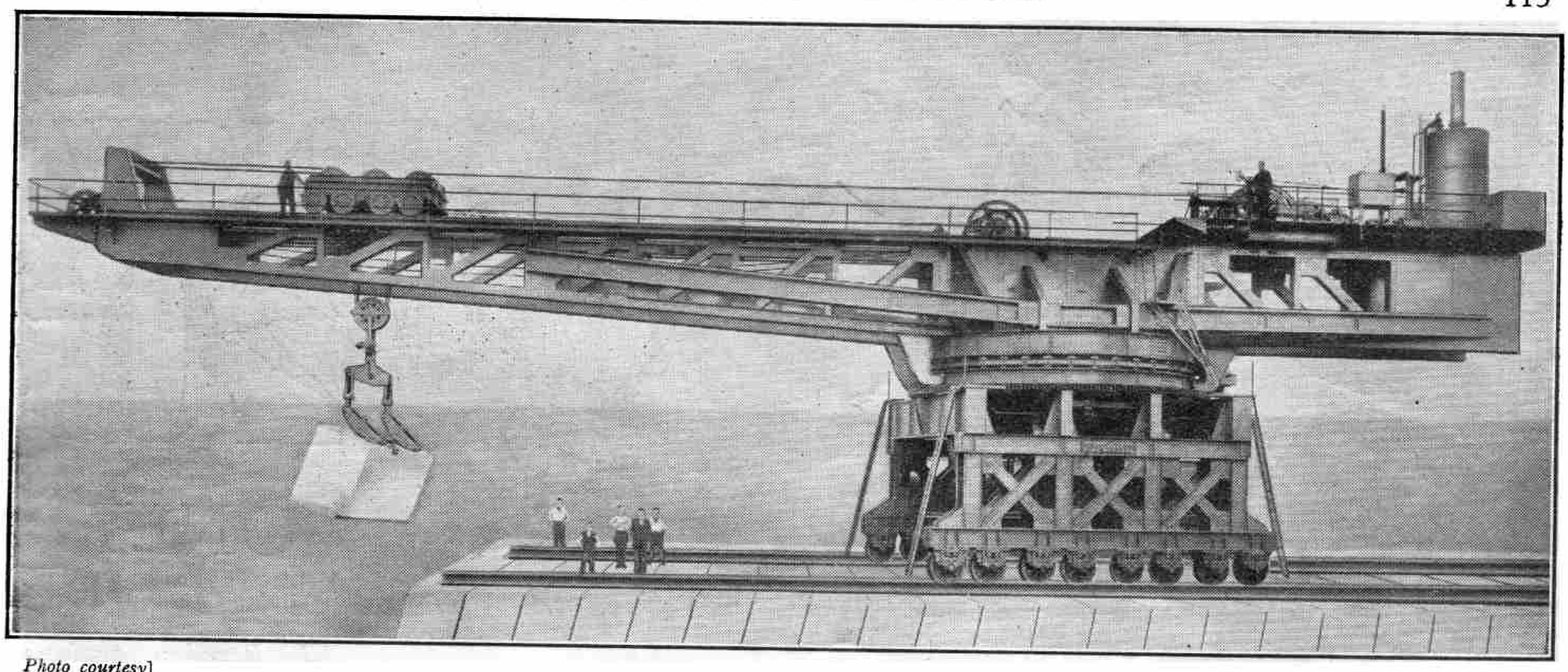


Photo courtesy] **A Giant "Titan" Crane, setting a concrete block on the end of a breakwater** [*Messrs. Stothert & Pitt Ltd.*

great expense, was carried out by divers who descended in diving-bells.

A diving-bell is an appliance that represents the present-day form of the earliest contrivances used to enable divers to remain under water any length of time. In its modern form a diving-bell consists of a bottomless iron box, weighing five tons or more. The divers take their places inside the bell, which is then lowered by a crane into the water. The pressure of the air in the bell prevents the water flooding it, just in the same way that the air in a tumbler keeps out the water if the tumbler is lowered below the surface of the water in an inverted position. Air is supplied to the men in the diving-bell by means of a pipe connected to a pump worked from above water, exactly as in the case of a man wearing a diving suit. As there is no bottom to the bell, the divers can stand and work on the sea floor in comfort, clearing and levelling it as required.

In the Dover Harbour works the largest diving-bells weighed 40-tons and contained four men comfortably. They were fitted with electric light, and telephones enabled the movements of the diving-bell to be directed by the divers themselves.

Construction of Dover Harbour

Each face of the walls of the breakwater at Dover is slightly inclined and each breakwater is surmounted by a parapet. When a westerly gale is raging these parapets protect the boat-trains that run on to the paved quay alongside the mail steamers, thus enabling them to discharge their mails and passengers under sheltered conditions.

The first part of the harbour works, which was completed in 1871 at a cost of £680,000, consisted of a breakwater 2,100 ft. in length, extending to a depth of about 48 ft. at low water. For some years this breakwater served the purpose required, but the continued increase in the amount of shipping, and the additional requirements for strategical purposes, rendered further work necessary.

Between 1898 and 1909 an additional scheme was carried out and two other breakwaters were built, enclosing a large area of anchorage, now known as the Admiralty Harbour, the construction of which was a great engineering feat. We are better able to gain some idea of the magnitude of the task that confronted the engineers when we learn that the total length of the breakwater is over two miles. The finished harbour is over 610 acres in extent and is sufficiently extensive to shelter a whole fleet. The work included the extension of the former breakwater by 2,000 ft., the reclaiming and excavation of a large portion of the chalk cliffs immediately behind the harbour, the building of a new breakwater at the south end, and a new breakwater, 3,850 ft. in length, at the east end.

Travelling Gantry Cranes Used

The breakwaters are between 50 and 60 ft. in width at their bases, and from 80 to 90 ft. in height. They are constructed of 42-ton concrete blocks, which were formed in special block-making yards erected under the shelter of the cliff. The blocks, which measure 14 ft. by 7 ft. by 6 ft., consist of a mixture of gravel, sand, and cement. This was poured into wooden moulds in liquid form, and when the mixture had set—for which a week was generally required—the sides of the moulds were removed and the blocks were ready for transport to the point at which the work was proceeding.

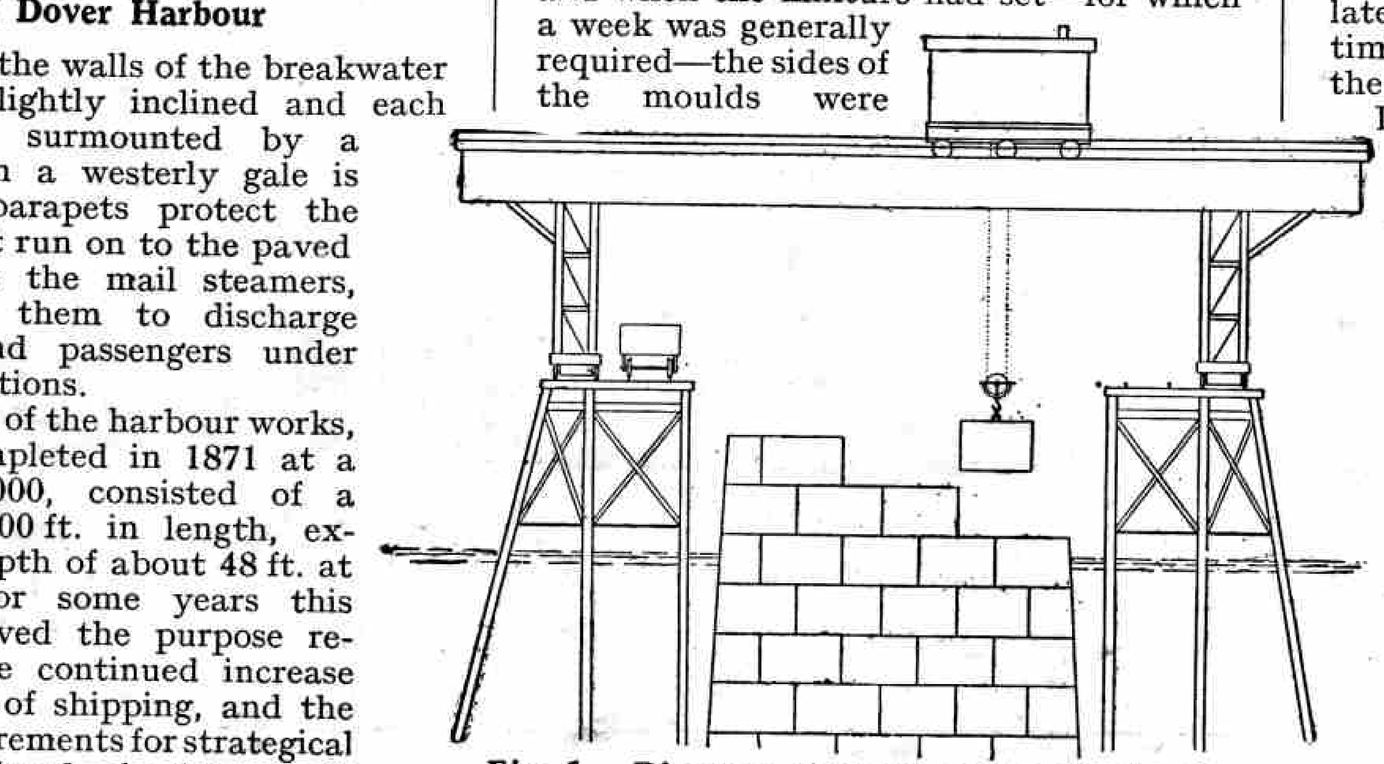


Fig. 1. Diagram showing how a Gantry Crane sets Concrete Blocks*

* This diagram, and that on page 140 are reproduced from "Engineering for Boys," by permission of Messrs. T. C. & E. C. Jack Ltd.

For transporting these huge blocks along the quay, huge Goliath cranes were employed, a type of crane which, under the name of Travelling Gantry Crane, is familiar to all our readers, model No. 728 in the Meccano Manual being an excellent reproduction.

The cranes ran on a track supported on a special platform, which, in view of the fact that the cranes weighed 100 tons unloaded, were very substantially supported. In the first place, ironshod piles, 100 ft. in length and 20 in. square, were driven into the sea floor in groups of six on each side of the line on which the breakwater was to be built. Each group was separated by a distance of 50 ft. and between the two lines of piles was a clear 70 ft. In all, the scheme required half-a-million cubic feet of timber, which was specially selected by an expert sent over to Tasmania for the purpose.

When the massive piles had been satisfactorily driven home by the powerful pile-drivers, cross-girders were placed from one row to the other. These were then braced diagonally by strong ties and laterally by lattice girders, and heavy timber flooring was laid down to take the two 100 ft. tracks for the Goliath cranes.

In effect, therefore, two solid piers had been erected with wooden supports and timbered floors, and braced one with another with cross girders. These enabled the gantry cranes to travel out to the end of the piers and to drop concrete blocks at any desired point between the shore and the pier ends, an operation made clear by the sectional view in Fig. 1. As the blocks were laid, the cranes advanced and so laid succeeding tiers, each tier being built up to the level of the finished breakwater before the next was proceeded with.

Keying the Blocks

The blocks were "dove-tailed" or fitted one into the other on all sides, in order to give the breakwater solidity to resist the fury of the waves,

(*Continued on page* 140)

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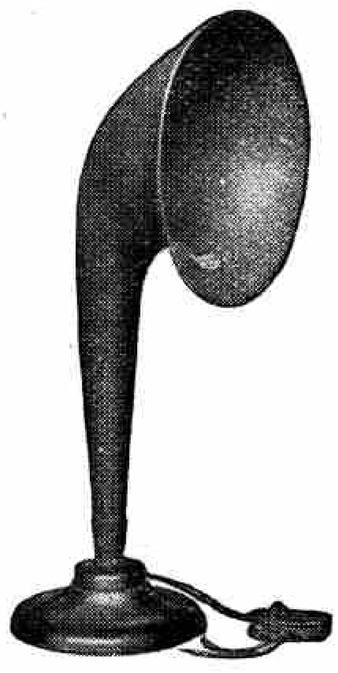

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TRADE MARK

The Meccano Idea

Steel Houses with Interchangeable Parts

by Stanley R. Money

Last month, by the courtesy of the Editor of the "Westminster Gazette" we were able to print an account of the remarkable invention of Mr. J. C. Telford, O.B.E., the eminent engineer who was the first to apply the Meccano idea to the housing problem. In an interview, Mr. Telford laid emphasis on the fact that his houses are built entirely on the Meccano principle, the whole structure being made of braced steel plates with turned-in flanges by which they are bolted together, exactly as in the case of Meccano plates.

No doubt Meccano has been the starting point of many inventions, but steel houses built on the Meccano principle are surely an entirely original and unlooked-for development. The article on this page, which has been specially written for the "M.M." by a member of Mr. Telford's firm, describes the construction of these Meccano houses, and I feel sure that it will be of considerable interest to all our readers.—Editor.

IN these times when brick houses cannot be reproduced in sufficient numbers to cope with the demand, another type of building, in the form of a steel house, may now be employed, thanks to the invention of the Meccano house. The inventor is Mr. J. C. Telford, O.B.E., M.Inst.C.E., of Messrs. Braithwaite & Co., Engineers, Ltd., who are producing these houses under the name of the "Telford ALL-Steel House."

In an interview Mr. Telford said: "Each house consists of a living room, kitchen, bathroom, scullery and coal cupboard on the ground floor, with three good bedrooms above. Everything possible is made of steel, even to the staircase, and every component part is made on the mass-production principle and has only to be fixed in place by bolts, exactly as the boy builds his wonderful Meccano bridges and cranes."

Method of Construction

The construction consists of steel plates forming the outer walls, and, in the case of two or more houses in a block, the main partition walls separating each house. The plates are so constructed that, in addition to forming the walls, they also provide both the vertical and horizontal weight-sustaining members of the entire structure. The inner walls are of thick asbestos or similar lining sheets secured to the framework. Between the outer steel plates and the inner asbestos sheets is hung an intermediate protective lining, this being fixed to the back of the inner framework. The windows are steel casements in wood frames, and the doors, cupboards, etc., are in wood. Chimney breasts are of steel construction similar to the main walls, with flues and chimney heads of cast iron. In the standard type house the roof also is of steel plates, but if desired it may be constructed in the ordinary way with slates or tiles.

How the Houses are Erected

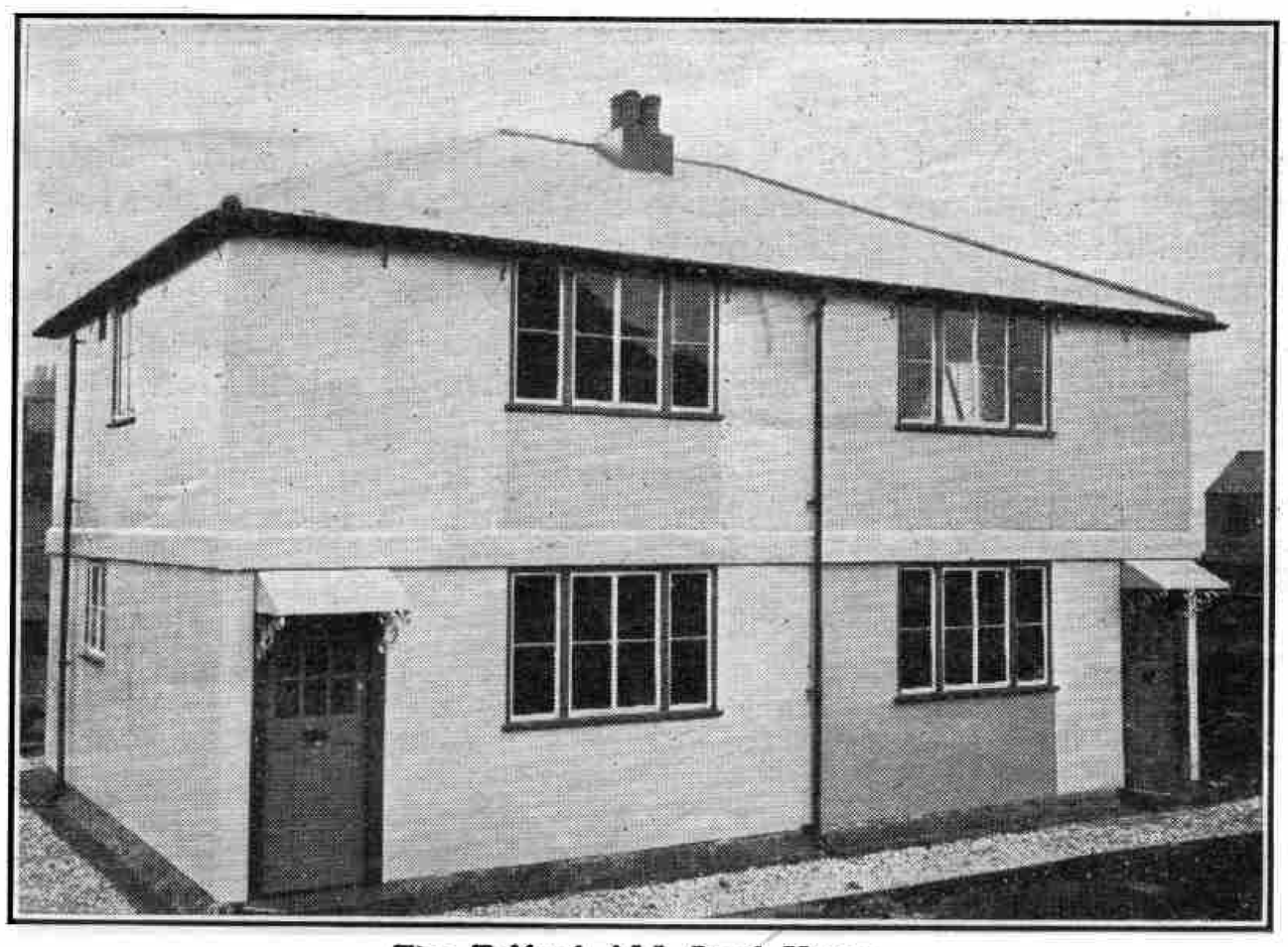
The chief advantage of these Meccano type houses lies in the fact that they are so simple to erect that no skilled labour is required. They are cheaper than brick houses, and one pair of these houses may be erected and ready for occupation within ten days of the foundations being completed.

The method of erection is as follows: The site is first prepared and levelled, and then a concrete raft or platform, which extends outward for 2 ft. beyond the walls of the house, is laid down, together with the necessary drains. The units for building the walls are similar to shallow steel boxes, consisting of steel plates 3 ft. 6 in. wide by 8 ft. 2 in. high, and with a $2\frac{1}{2}$ in. flange all round. These plates, together with the door and window frames, are sent from the works ready marked to correspond with a key plan provided. Thus the erection of a Meccano house is as simple as the building of a Meccano model from the instructions given in the Manual. The plates are held vertically with the flanges to the inside of the house. By means of these flanges adjoining plates are bolted together and to the concrete foundation, a special composition being introduced into the joints to render them absolutely weather-proof. The ground floor consists of boarding screwed into creosoted wood fillets let into the concrete raft.

When the erection of the ground floor walls is completed the top flanges of the plates are tied across by means of the horizontal stringer course and the floor flitch beams which run the whole width of the house. From these beams the first floor walls and roof are erected. The staircase is made of steel on to which wooden treads are bolted.

Painting to Last Five Years

The outer face of the steel plates is prepared and painted with a special rust-resisting paint and finished warm stone colour, and sand is sprinkled on the walls while wet. The doors and window frames are painted to suit the tastes of purchasers. The up-keep of the exterior painting is small, as the paint manufacturers have gone carefully into the cost and find that a pair of houses can be painted one coat, including labour, for less than £4. This paint will last at least five years, even where the house is near the sea or in districts where the air is laden with chemical fumes. The inner faces of the plates are protected from rust by bitumastic or other solution. The maintainence charges of these houses should be low compared with those of houses of brick or concrete construction, for there is no rough cast to replace, no brickwork to be re-pointed, no timber facings to be renewed and no re-plastering of interior walls, ceilings, etc. All that is required for the Meccano house is a re-coating of the exterior plates with the solution originally used in the manufacture.



The Telford ALL-Steel House

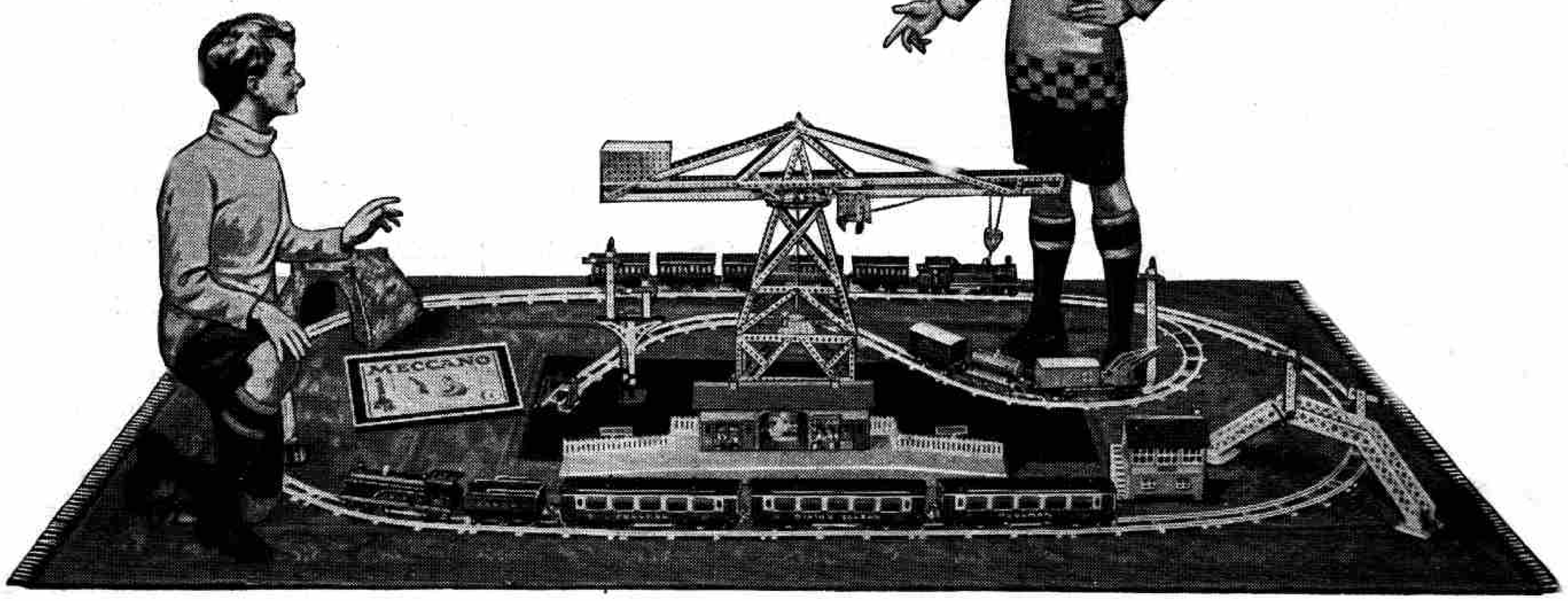
Interchangeable Parts

The walls of the rooms consist of thick sheets of asbestos or other similar material screwed to a wooden framework bolted inside the steel plates. A sealed 6 in. cavity is left between the outer walls, thus rendering the house free from condensation. This cavity is in contact with the roof, the exterior of the chimney flue and the interiors of the grates. The chimney flues are made of cast iron pipes, and any heat transmitted by the chimney is re-transmitted round the house by virtue of the contact of these flue pipes with the air in the cavity or roof space as the case may be. The sealing of the cavity at all points ensures complete protection against vermin.

(*Continued on page* 137)

HORNBY CLOCK WORK TRAINS

THE TRAINS WITH THE GUARANTEE



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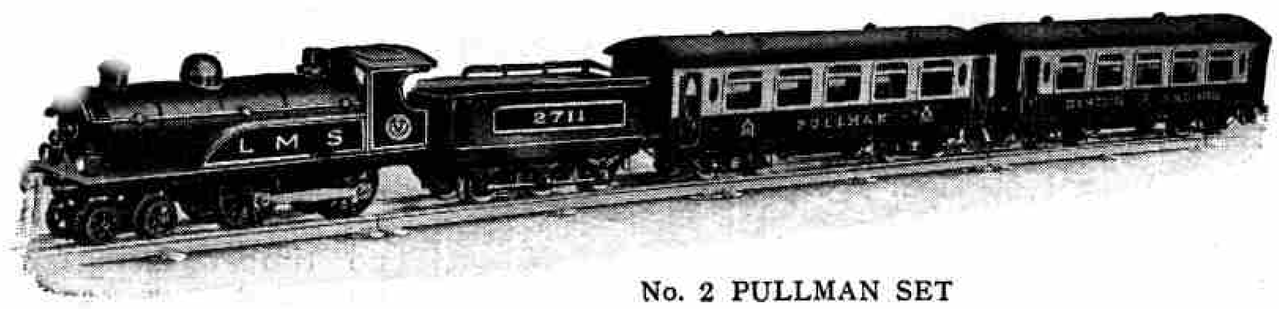

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No. 2 Pullman Set

The No. 2 Loco with Tender measures 17 in. in length. The Loco is fitted with superior mechanism and the accurately-cut gears ensure smooth running. Loco, Tender and Coaches are superb in appearance and finish, enamelled in colours and stoved at a high temperature to ensure durability. The Loco is fitted with reversing gear, brake and governor.

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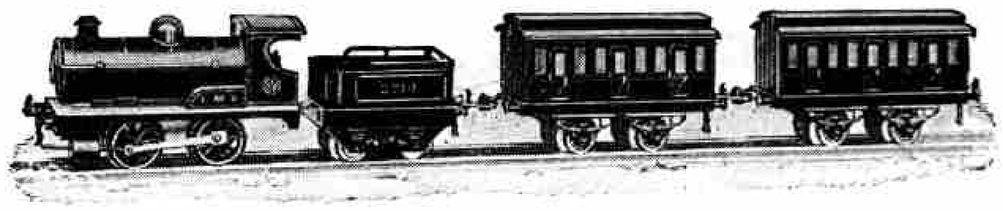

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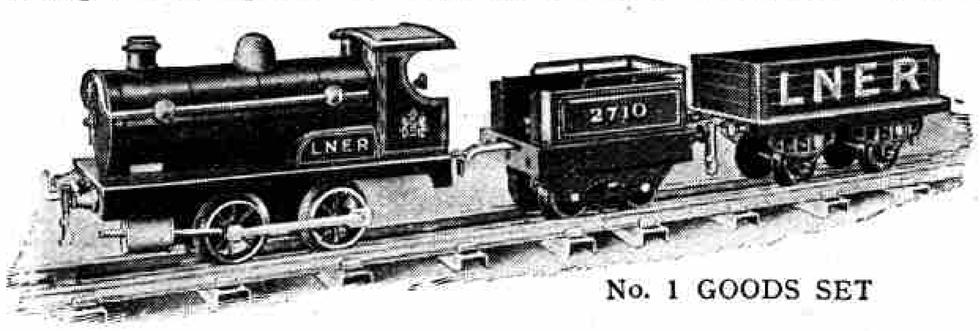

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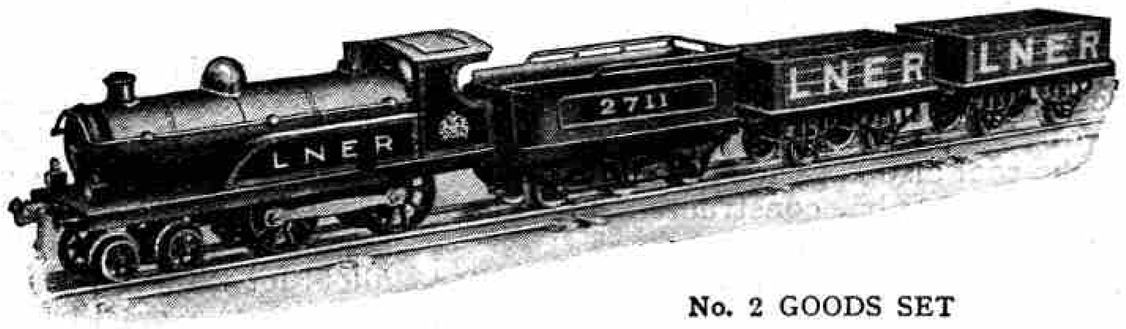
Gauge 0 in colours to represent the L.M.S. or L.N.E.R. Companies' rolling-stock. Each Loco is fitted with reversing gear, brake and governor. Each set comprises Loco, Tender, one Wagon, and set of rails as in the No. 1 Passenger Set. Price 22/6

No. 1 Hornby Loco	Price 15/-	Hornby Passenger Coach	Price 5/-
„ „ Tender	„ 2/6	No. 1 Hornby Wagon	„ 2/6

No. 2 Goods Set

Gauge 0 in colours to represent the L.M.S. or L.N.E.R. Companies' rolling stock. This set contains Loco, Tender and Rails as in the No. 2 Pullman Set, and two Wagons. Loco fitted with reversing gear, brake and governor. Price 37/6

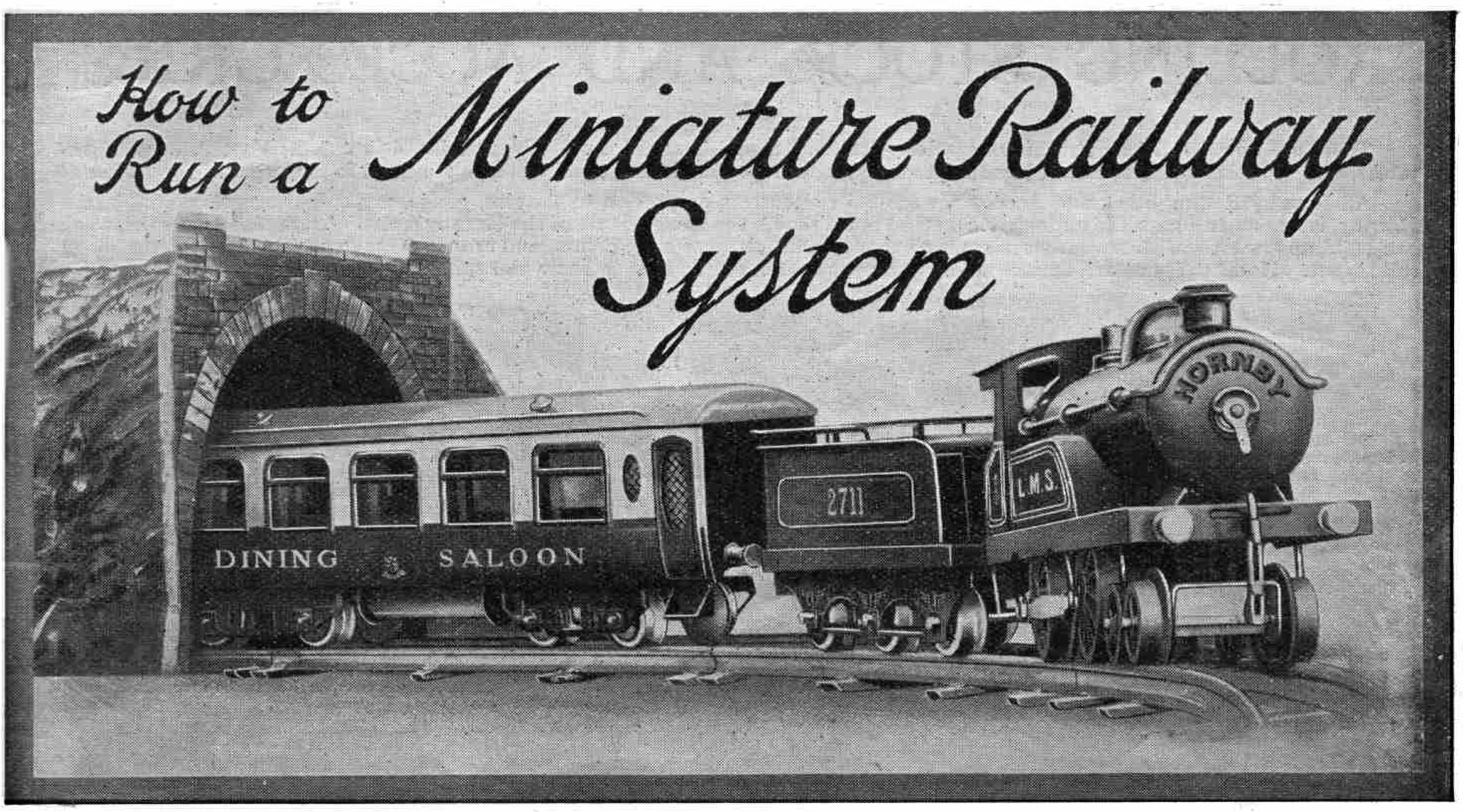
No. 2 Hornby Loco ...	Price 22/6	Hornby Pullman or Dining Car ...	Price 15/-
„ „ Tender	„ 3/6	No. 2 Hornby Wagon	„ 2/6



No. 2 GOODS SET

Ask to see Sample Sets at your Toy Store

MECCANO LTD., BINNS ROAD, LIVERPOOL



VI. MECCANO AND HORNBY LAYOUTS

IN the previous articles of this series we have endeavoured to show some of the many ways in which Hornby track may be laid out, and also to give suggestions as to the best methods of working a layout so as to obtain the greatest amount of fun. It is probable that the majority of boys who are the happy owners of a Hornby Train set are also Meccano enthusiasts, and in this article we intend to show how the two may be combined with the most interesting results.

Loading and Unloading Wagons

The fun of running a Hornby Goods Train, for example, may be increased very greatly by the use of one of the many types of Meccano Cranes for the purpose of loading and unloading the wagons. Several of the simpler types of crane may be set to work in this manner by the exercise of a little ingenuity.

Among these are Models Nos. 30, 38 and 42, which can be made with a No. 0 Outfit; and 105, 113, 119 and 127, made with a No. 1 Outfit. The simplicity of all these cranes makes the various loading and unloading operations quite a straightforward matter. Of course very many other Meccano cranes may be used for this purpose, and we only mention the foregoing models as being easily and quickly built with small outfits.

As regards the loads for the wagons, the miniature Meccano Sacks (part No. 122) are very useful, and in addition an almost infinite variety of loads of different kinds may be improvised from materials to be found in every house. Empty cotton reels may represent casks and barrels, and beads or dried peas make excellent material for tipping wagons.

A particularly interesting combination consists of a Hornby Goods Train and a Telpher Span (Models Nos. 36 or 108). The Telpher Span may be connected up across the room and made to convey material from, say, an imaginary quarry to a goods siding, ready to be loaded into the wagons by means of one of the cranes already mentioned.

Fun with Telpher Span

This operation may be made a great success if two or more boys are working together. The material may be brought from the quarry, loaded into the wagons and then the train despatched to its destination. There the wagons may be unloaded at once, or they may be shunted into a siding and another train of empty trucks made up. In the meantime the Telpher Span is at work bringing fresh material for a second load. With a little experiment in timing the various operations the process may be developed on quite realistic lines. There are also possibilities of a similar character in the Endless Rope Railway (Model No. 109).

A goods warehouse is a very useful addition to any railway, and for this purpose Model No. 406 can be recommended. Many extremely interesting operations may be carried out by means of this warehouse worked in conjunction with a crane. One of the best schemes consists in combining the warehouse with the Overhead Crane, Model No. 116.

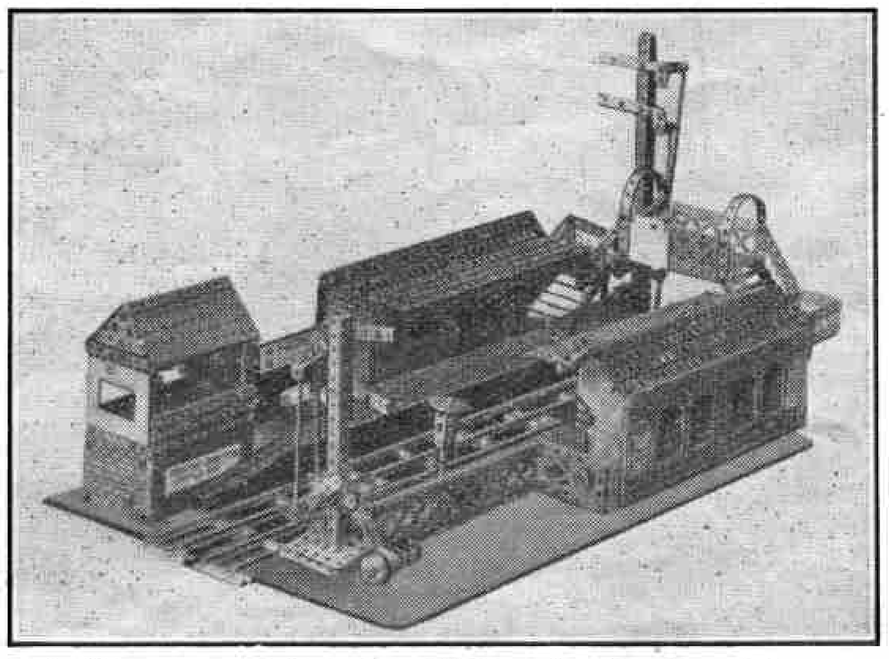
Goods Warehouse Combined with Crane

It will be found that the two models need slight alteration in order to make them work well together. One of the Flanged Sector Plates forming the base of the crane may be reversed so as to come inside the upright Strips instead of outside. This will enable the crane to be brought close up to the rails on which the wagon to be loaded is standing. The other Flanged Sector Plate may then be removed and the uprights bolted by means of Angle Brackets to the $5\frac{1}{2}$" Strip in the base of the Warehouse, in order to allow the crane to travel far enough forward to lower its loads into the warehouse cage. Before this can be done successfully, however, the $5\frac{1}{2}$" Strip bolted to the Angle Girders at the level of the first floor of the warehouse must be moved a good deal higher up in order to allow of the unobstructed movement of the crane.

The more elaborate warehouse, Model No. 372, also may be adapted in a similar manner, but of course this model is only available to boys fortunate enough to possess a No. 7 Outfit.

Boys who have large outfits may be recommended to experiment also with the following models: Gantry, No. 425; Travelling Gantry, No. 575; and Travelling Crane, No. 526. The Dredger, Model No. 762, should not be overlooked,

(*Continued on page* 119)



A Meccano Model of a Station by D. Crankshaw, of Nelson

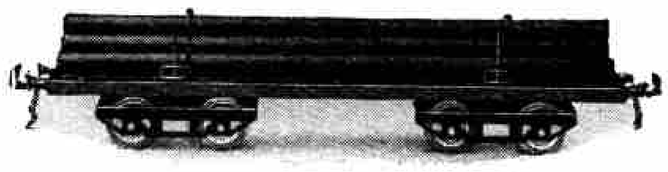
ROLLING STOCK AND ACCESSORIES

(HORNBY SERIES)

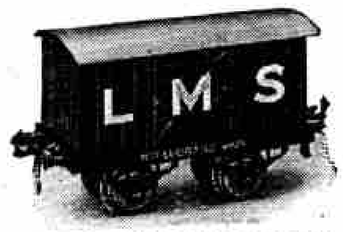
There are now 50 different train accessories—Stations, Signal-boxes, Lamps, Wagons, Level-Crossings, Foot-Bridges, Turntables, etc. Further accessories will be added to the system from time to time, and will be announced in the pages of the "*M.M.*"

All Hornby Rolling Stock and Accessories are built in correct proportion to the size, gauge, method of coupling, etc., of the Hornby Trains and all have the uniformly beautiful finish that is the great feature of the Hornby series. With these accessories you can build up a most realistic railway system, and the splendid range of rails, points, and crossings make possible endless variety in rail layout. Hornby Trains are British made, and your dealer will be able to show you specimens of the new products.

SIDE TIPPING WAGON
Excellent design and finish.
Price **3/6**

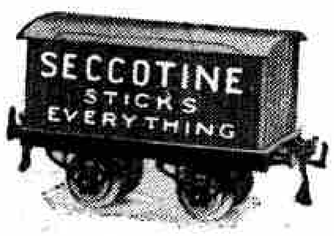


No. 2 LUMBER WAGON
Fitted with bolsters and stanchions for log transport. Suitable for 2 ft. radius rails only. Price **5/–**

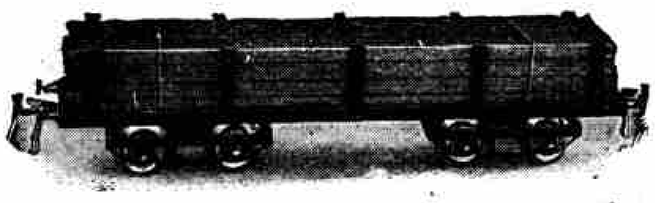


No. 1 LUGGAGE VAN
Representative colours.
Price **4/–**

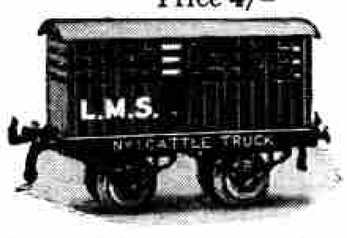
No. 2 LUGGAGE VAN
Finished in colour. Fitted with double doors. Suitable for 2 ft. radius rails only. Price **6/6**



SECCOTINE VAN
Price **4/–**

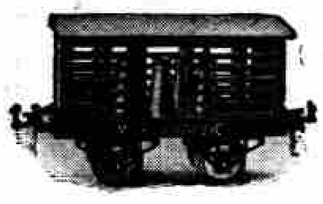


No. 2 TIMBER WAGON
Beautifully enamelled in colour and stoved. Suitable for 2 ft. radius rails only. Price **4/6**



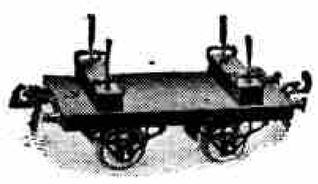
No. 1 CATTLE TRUCK
Fitted with sliding door.
Very realistic design.
Price **4/–**

No. 2 CATTLE TRUCK
Splendid model fitted with double doors. Suitable for 2 ft. radius rails only. Price **6/6**

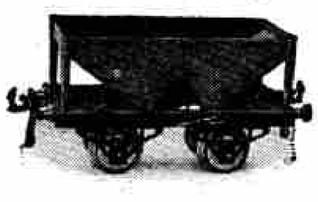


MILK TRAFFIC VAN
Fitted with sliding door, complete with milk cans. Price **4/6**

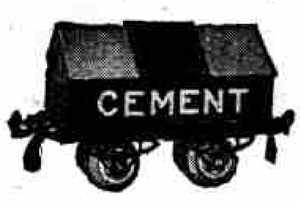
ROTARY TIPPING WAGON
Finished in colour.
Price **4/–**



No. 1 LUMBER WAGON
Fitted with bolsters and stanchions for log transport. Price **2/–**

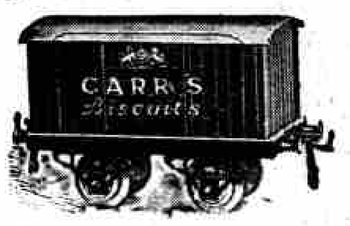


HOPPER WAGON
Mechanically unloaded.
Finished in colour. Price **4/–**



CEMENT WAGON
Finished in colour.
Price **4/–**

GUNPOWDER VAN
Finished in red.
Price **4/–**

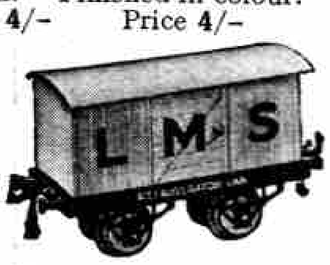


BISCUIT VAN
Price **4/–**

No. 1 TIMBER WAGON
Beautifully enamelled in colour and stoved. Price **2/–**

GAS CYLINDER WAGON
Finished in red, lettered gold.
Price **3/–**

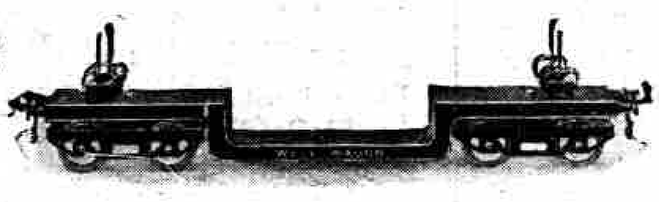
PETROL TANK WAGON
Finished in colour.
Price **3/–**



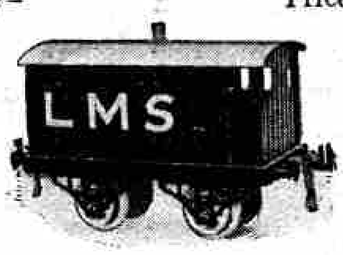
REFRIGERATOR VAN
Enamelled in white, lettered black. Price **4/–**

SNOW PLOUGH
Finished in grey, with revolving cutter driven from front axle.
Price **5/6**

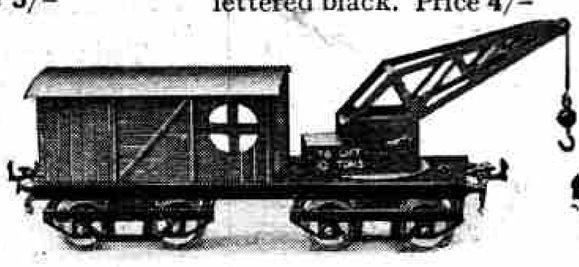
CRANE TRUCK
Working model.
Finished in colours.
Price **4/6**



TROLLEY WAGON. Finished in colour. Suitable for 2 ft. radius rails only. Price **6/–**

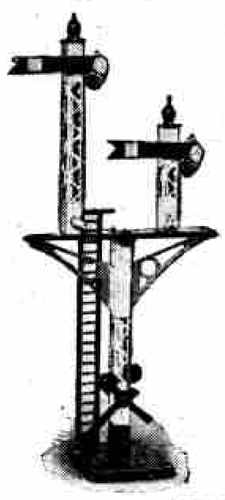


BRAKE VAN
Finished in colour.
Price **4/–**

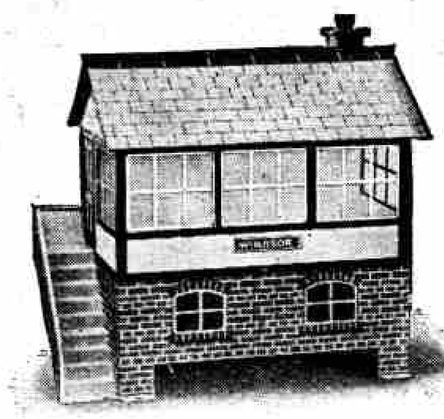


BREAKDOWN VAN AND CRANE
Excellent finish. Beautifully coloured. Suitable for 2 ft. radius rails only. Price **7/–**

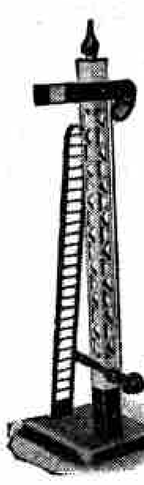
GUARD'S VAN
Price **5/–**



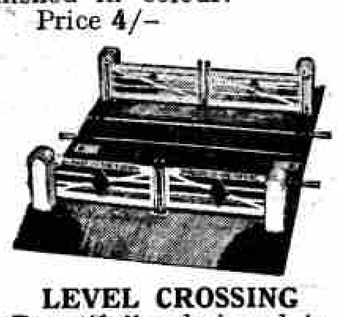
JUNCTION SIGNAL
Signal arms operated by levers at base. Very realistic model standing 14 in. in height. Price **5/6**



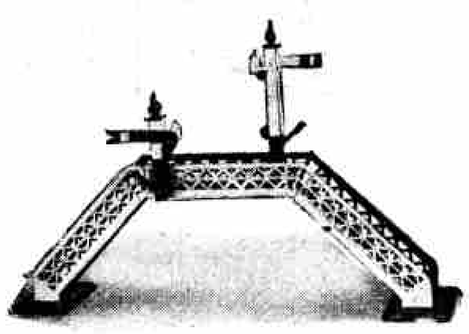
SIGNAL CABIN
Dimensions: height 6½ in., width 3½ in., length 6½ in. Finished in colour and lettered "Windsor." Roof and back open to allow signal-levers to be fitted inside cabin if desired. Price **6/6**



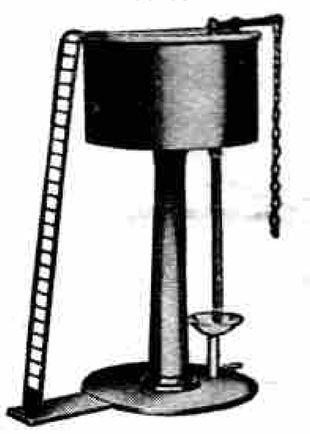
SIGNAL
Price **2/6**



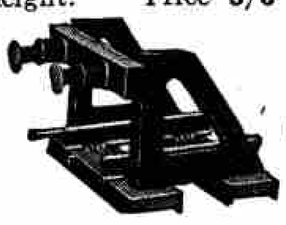
LEVEL CROSSING
Beautifully designed in colour. Measures 11½ in. × 7½ in., with Gauge 0 Rails in position.
Price **6/6**



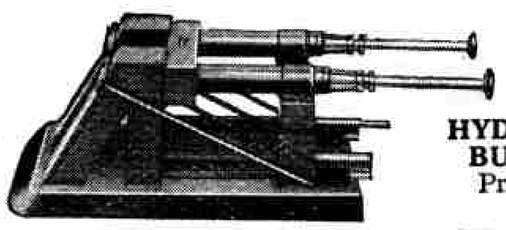
FOOT-BRIDGE
No. 1. With detachable signals. Price **6/–**
No. 2. Without signals. Price **3/6**
Signals, per pair **2/9**



WATER TANK
Brightly coloured in red, yellow and black, 8½ in. in height, with flexible tube and pump lever.
Price **6/6**

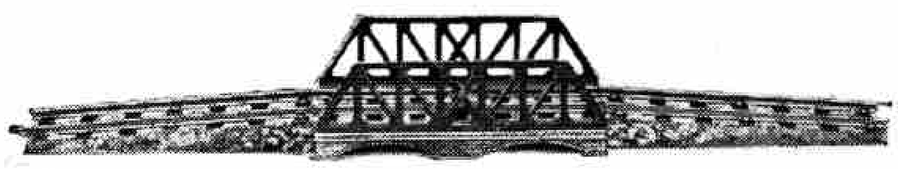


SPRING BUFFER STOP
Price **1/6**



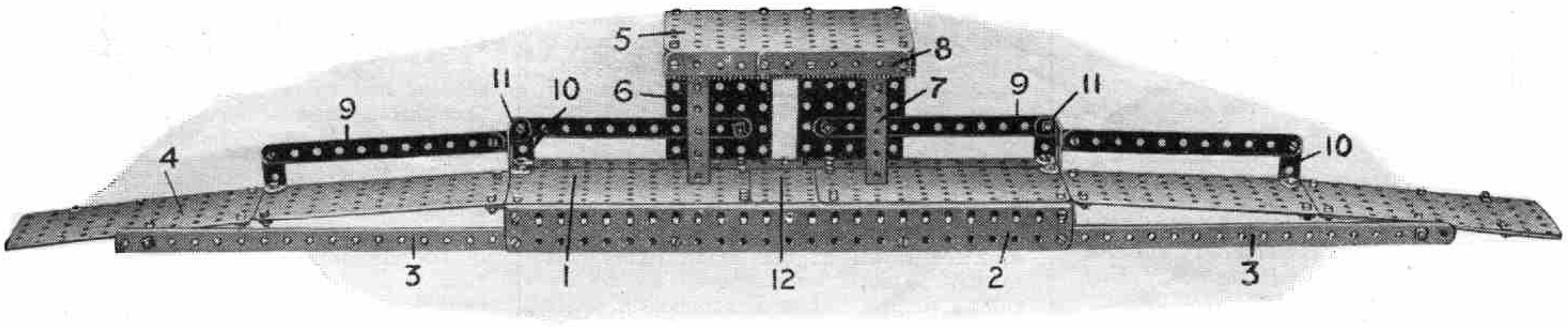
HYDRAULIC BUFFERS
Price **5/–**

TUNNEL
Price **7/6**



VIADUCT, complete with approaches. Price **7/6**

ASK YOUR DEALER TO SHOW YOU SAMPLES



" Windsor Station " reproduced in Meccano. The following parts are required :—

6 of No. 1	2 of No. 9A	6 of No. 12B	3 of No. 52A	1 of No. 72	2 of No. 110
4 ,, ,, 2	1 ,, ,, 9B	82 ,, ,, 37	2 ,, ,, 53A	2 ,, ,, 103B	2 ,, ,, 124
2 ,, ,, 8	8 ,, ,, 12	2 ,, ,, 48B	4 ,, ,, 70	1 ,, ,, 103H	

Miniature Railways—(*Continued from page* 117)

for if carefully adjusted it forms a remarkably effective combination with a railway.

Layout including Forth Bridge

For Exhibition purposes there is nothing more effective than the Forth Bridge, Model No. 722, in connection with a fairly extensive layout, and this combination may be strongly recommended to those Meccano Clubs which have not yet launched out in this direction. The spectacle of Hornby Trains running over this bridge never fails to attract a great deal of attention, and has often been the means of making people realise for the first time how great are the possibilities of combining Meccano with the Hornby system.

A Meccano Station

Two of the layouts illustrated in last month's Model Railway article required two stations. Many readers who have Hornby Train sets have only the one " Windsor " station and we have frequently been asked for a design for a station in Meccano. On this page we therefore reproduce a photograph of a very fine station built entirely in Meccano. This station is approximately the same length as the " Windsor " station and the platform is the same height. The two stations therefore may be placed facing one another thus forming a very effective double-road station.

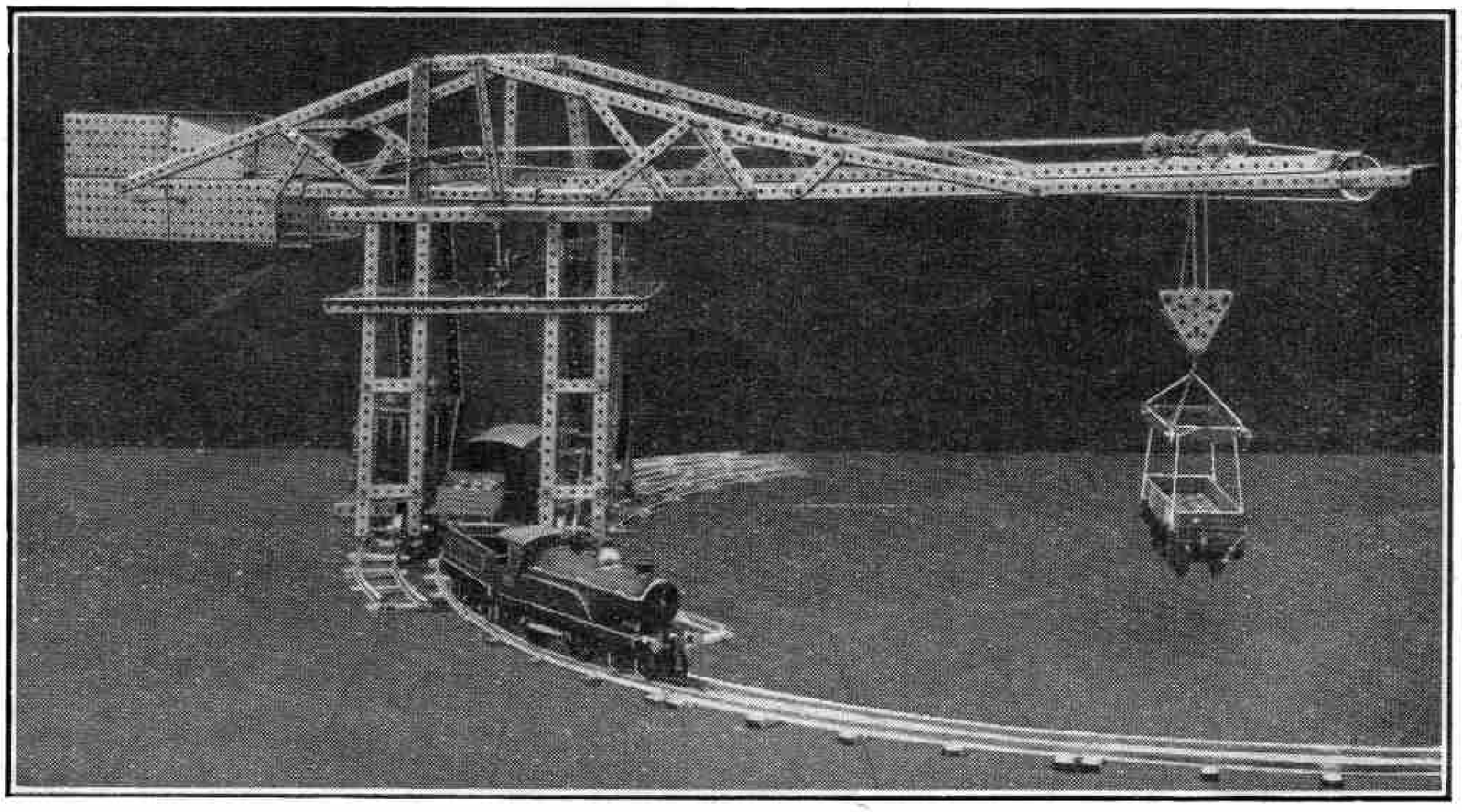
Constructing the Station

The main platform is composed of $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates (1), bolted to $12\frac{1}{2}''$ Angle Girders, and supported by $12\frac{1}{2}''$ Flat Girders (2) forming the sides. Secured at each end of the front Flat Girder (2) are $12\frac{1}{2}''$ Strips (3) overlapped 8 holes, which, by means of Angle Brackets bolted in the second hole from their outer ends, hold in position the approaches (4). The latter are constructed with $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates butted together and mounted on further $12\frac{1}{2}''$ Strips, which are overlapped 3 holes and bolted to the main platform.

The shelter (5), the roof of which is formed by a $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plate, is supported by two $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates (6) bolted to the main platform. The roof also rests upon $3\frac{1}{2}''$ Double Angle Strips (7) and has for ornamentation two Rack Strips (8) bolted by Angle Brackets to its outer edge.

The rails enclosing the platform are constructed from $5\frac{1}{2}''$ Strips (9) supported by $1'' \times \frac{1}{2}''$ Angle Brackets (10). The corners of the main platform are negotiated by means of 1" reversed Angle Brackets (11). The space between the two large Flat Plates (1) in the main platform is bridged by a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate (12).

A $1\frac{1}{2}''$ Flat Girder is bolted across the top of the opening at the back of the shelter, and in order to add further to the appearance of the model, steps lead down from this opening to ground level. These steps may be constructed by bolting a $4\frac{1}{2}''$ Angle Girder to the back of the platform, in the second hole from the ground. To the projecting flange of this Girder a second $4\frac{1}{2}''$ Angle Girder is bolted, and to the latter a further $3\frac{1}{2}''$ Angle Girder is then secured.



A Fine Model, from the 1924 Model-Building Contest

Wayside Stations

No doubt Meccano boys will find many ways in which this model may be improved, such as in the addition of name-boards, seats, etc., but we have purposely made the model as simple as possible, well knowing that such obvious details usually suggest themselves to our readers without any help from us !

It is possible that some ambitious readers will also start building wayside stations, island platforms, and all kinds of railway buildings with Meccano. For a wayside station the model described above may prove a little large, except, of course, for those boys who are the fortunate owners of almost unlimited stretches of track ! This defect, however, may very easily be remedied by shortening the " approaches " on either side of the platform. Quite an effective arrangement is obtained, for example, by using one $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate instead of two for the slopes at each end. Where parts permit, an excellent plan, of course, is the addition of booking offices and other familiar features of a railway station.

Island Platforms

" Island " platforms are very simple to construct. The roof, shaped like an extended V inverted, should be supported by columns—constructed from, say, Meccano Rods held in position by Cranks—arranged down the centre of the base. In this way the base is divided, as it were, into two platforms, which may be used for the " Up " and " Down " lines.

As another example of this type of Meccano model we illustrate a railway station which, readers will remember, was constructed by D. Crankshaw, of Nelson, for our big model-building competition last year. Comprising two platforms, signals, footbridge, signal-box, etc., the model shows many new and ingenious uses of Meccano parts.

Lives of Famous Engineers

(*Continued from page* 111)

In order to fill up this hole, bags filled with clay were thrown into the river in great quantities, and by 11th June, when about 19,500 cubic ft. had been thrown into the hole, pumping was successfully resumed. By 25th June the water was completely removed from the shaft and from about 150 ft. of the tunnel. The next step was to clear the deposited rubbish from the cells of the shield frames, during which operation the ground frequently slipped in and permitted a great increase in the quantity of water.

By the end of July matters were again in working order, but a few days later Brunel, utterly worn out with the incessant labour and anxiety to which he had been exposed, was seized with a very serious illness and was confined to his room for many weeks. Work was carried on in the meantime, but under much greater difficulties than before owing to the extreme foulness of the air. The central ventilator had been choked by the irruption and a timber one to supply its place had not been completed. In spite of this, however, the work proceeded, slowly but surely, during the months of October, November and December.

Second Irruption

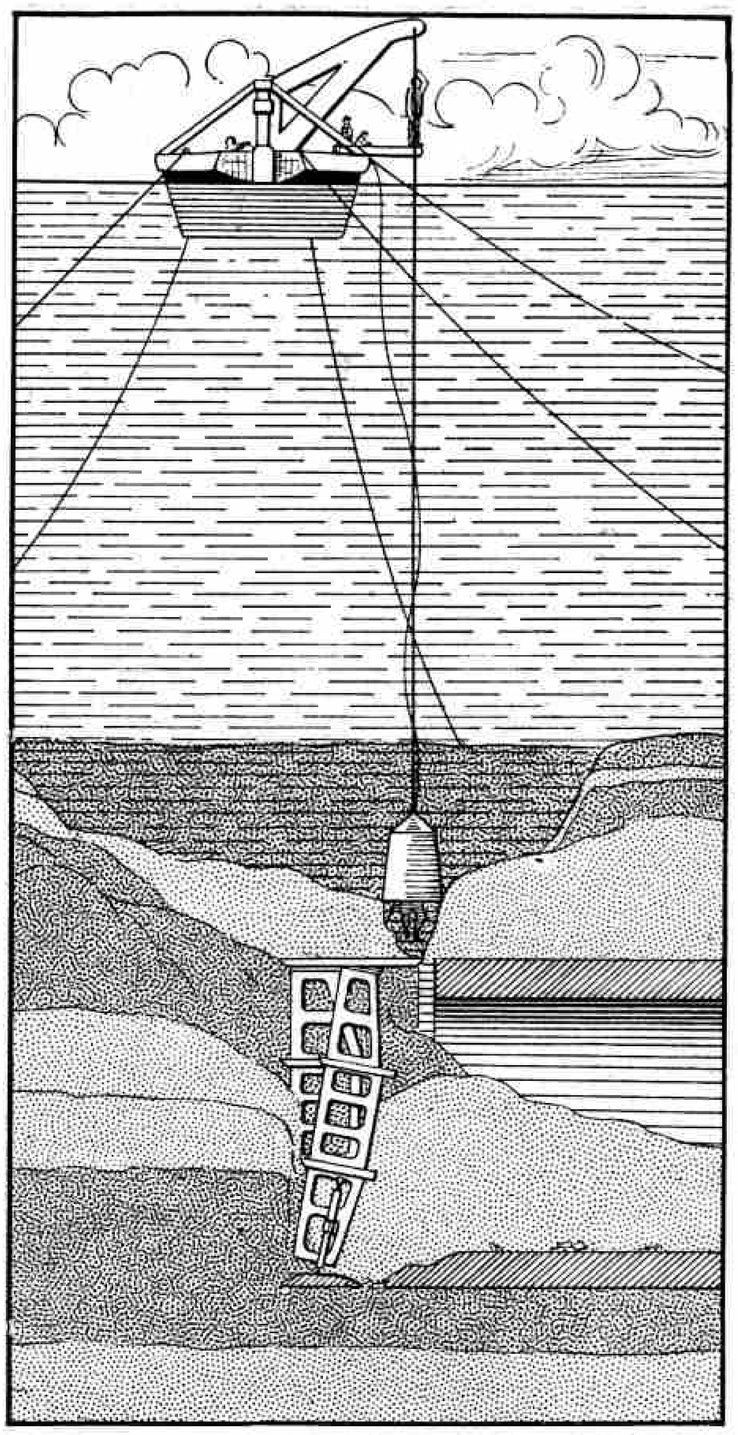
As the year closed, the west side of the excavation became increasingly troublesome, however, and on 12th January, 1828, a second and more serious irruption occurred which put a stop to the work for seven years. The particulars of this accident are thus described by Isambard Brunel (junior) in a letter to the directors of the Tunnel Company.

"I had been in the frames with the workmen throughout the whole night, having taken my station there at ten o'clock. During the workings through the night, no symptoms of insecurity appeared. At six o'clock this morning (the usual time for shifting the men) a fresh set or shift of the men came on to work. We began to work the ground at the west top corner of the frame: the tide had just then begun to flow; and finding the ground tolerably quiet, we proceeded by beginning at the top, and had worked about a foot downwards, when, on exposing the next six inches, the ground swelled suddenly, and a large quantity burst through the opening thus made. This was followed instantly by a large body of water. The rush was so violent as to force the man on the spot, where the burst took place, out of the frame (or cell) on to the timber stage behind the frames. I was in the frame with the man, but upon the rush of water I went into the next box (or cell), in order to command a better view of the irruption, and seeing that there was no possibility of then opposing the water, I ordered all the men in the frames to retire.

A Thrilling Experience

"All were retiring, except the three men who were with me, and they retreated with me. I did not leave the stage until those three were down the ladder of the frames, when they and I proceeded about twenty feet along the west arch of the tunnel. At this moment the agitation of the air, by the rush of water, was such as to extinguish all the lights, and the water had gained the height of our waists.

"I was at that moment giving directions to the three men, in what manner they ought to proceed in the dark to effect their escape, when they and I were knocked down, and covered with a part of the timber stage. I struggled under water for some time, and at length extricated myself from the stage, and by swimming and being forced by the water, I gained the eastern arch where I got a better footing, and was enabled, by laying hold of the railway rope, to pause a little, in the hope of encouraging the men who had been knocked down at the same time with myself. This I endeavoured to do by calling them. Before I reached the shaft the water had risen so rapidly that I was out of my depth, and therefore swam to the visitors' stairs, the stairs for the workmen being occupied by those who had so far escaped. My knee was so injured



Examining river bed from diving bell after irruption

by the timber stage that I could scarcely swim, or get up the stairs, but the rush of the water carried me up the shaft. The three men who had been knocked down with me were unable to extricate themselves, and I am grieved to say, they are lost; and I believe also two old men, and one young man, in other parts of the work."

Company's Funds Exhausted

As in the case of the previous irruption the hole was filled up by clay and gravel, about 4,500 tons being required in this instance. The tunnel was then pumped clear of water, but as the funds of the company were exhausted it was determined that the frames should be bricked up and work stopped pending an appeal to the country for the funds necessary to complete the scheme. The general public and many eminent persons, including the Duke of Wellington, displayed great enthusiasm in the matter, but the necessary money was not forthcoming and the scheme had to be abandoned until more favourable times.

Government Assistance

After considerable pressure had been brought to bear upon them the Government decided to come to the assistance of the company, and consented in 1834 to make a loan to the company of £246,000, the first instalment of £30,000 being advanced in December 1834. Isambard Brunel by this time was so busily engaged on independent engineering work that he was unable to resume his tunnel labours, and when work was once more commenced, in January 1835, Richard Beamish, Sir Marc Brunel's biographer, was appointed resident engineer.

The old shield was removed and a new one containing many important improvements was substituted. The remaining portion of the tunnel was steadily excavated, in spite of three more irruptions of the river. In October 1840, the shaft on the Wapping side of the river was commenced. This differed from the Rotherhithe shaft in that it was made slightly conical in shape to reduce friction, and was sunk to the required depth, 70 ft., without resorting to under-pinning. The shield was then brought up to the brickwork of the shaft and the difficult operation of effecting a junction between tunnel and shaft was satisfactorily accomplished. The tunnel was opened on 25th March, 1843—a little over 18 years from the commencement of the work.

In fifteen weeks from the day on which the Thames Tunnel was opened more than one million persons from almost all the civilised nations of the world had visited it. and paid tribute to the genius of its designer.

Before the tunnel was finally completed Marc Brunel received the honour of knighthood, upon which he received hosts of congratulations from his many admirers and friends. His old friend Earl Spencer, writing to him on this occasion said: "You have fairly earned your title by long continued and able services to the country; and it is a memorial of those services and consequently highly honourable to you."

Brunel's Declining Years

With the completion of the Thames Tunnel, Sir Marc Brunel's professional career may be considered to have terminated. He steadily declined all offers of employment connected with any of the great engineering undertakings of the day, and settled down in London, in a house facing St. James's Park, to enjoy his remaining years in peace. In 1845 he had a serious attack of paralysis and had to withdraw altogether from general society. From this time he gradually sank, and died on the 12th December, 1849, in his 81st year.

Sir Isambard Brunel was below middle stature and had a conspicuously large head. His forehead was so striking that his biographer, Beamish, tells us that a certain Irishman exclaimed to him: "Why, my dear fellow, that man's face is all head!" His habits were simple and unostentatious. He was a great favourite in society on account of his quite humour as well as his extensive knowledge.

(*Continued on page* 139)

Electricity or Steam

MR. R. H. SELBIE, C.B.E., General Manager and Director of the Metropolitan Railway, discussing in "*Modern Transport*" the question of the relative merits of electricity and steam for heavy suburban passenger traffic, says his personal view is that there is scarcely any case of a suburban line running out of London that would not repay the cost of electrification. At the same time he admits that it is impossible to lay down hard and fast rules to decide the electrification question generally.

Mr. Selbie believes that on a line that has reached its normal capacity for steam working during, at any rate, the rush hours, and where the traffic demands even more trains, an adequate electrical service could be provided at a lower price than with steam power. The problem to be solved is that of increasing the train-carrying capacity of a line without widening it or having to enlarge the terminal stations, and the solution lies in the substitution of electricity for steam power. One of the chief advantages of electrical working, says Mr. Selbie, is that by the use of electric trains on the "multiple unit" principle—that is with motors and driving apparatus at each end—the shunting of engines is obviated, and the occupation of platform roads is reduced by half. Further great advantages of electric trains are quicker acceleration and greater flexibility, due to the ease with which the composition of the trains can be adapted to meet the varying needs of traffic at different periods of the day.

Mr. Selbie concludes: "The long-distance traffic on the trunk lines of the country is handled to-day in a way that leaves little to be desired, and if the same spirit of enterprise that has brought these services to their present state were to be applied to the problem of short distance and suburban traffic, the result could not fail to be to the advantage both of the public and the companies themselves."

* * * *

New Locos for Home and Abroad

Three new locomotives have recently been completed for service in Nigeria. They are of the side tank shunting type and have been specially designed for service on the Nigeria ferry slipways. They are built to the 3 ft. 6 in. gauge and the wheels are 3 ft. 6¾ in. in diameter.

Thirteen passenger tank engines of the 4–6–2 type are being constructed at Newcastle-on-Tyne for the L.N.E.R.

Twenty locos of the 4–6–0 type are being constructed in Glasgow for the Southern Railway.

Two large and exceptionally powerful Garratt locos are being constructed in Manchester for the Bengal-Nagpur Railway in India. These locos are to be of the 2–8–0–0–8–2 type, and in working order weigh approximately 170 tons. They will be fitted with four cylinders and the coupled wheels will have a diameter of 4 ft. 8 in. The engines will be capable of hauling a train load of 1,500 tons on a gradient of 1 in 100.

* * * *

Conversion of Southern Locos

A number of Southern Railway four-cylinder 4–6–0 type locos, with driving wheels 6 ft. in diameter, are to be converted into two-cylinder super-heated locos. As an experiment one of these locos, No. 449, has been converted by re-arranging the cranks, so that eight light exhaust discharges take place during each revolution of the driving wheels, instead of four heavy "puffs," as is the case with the original four-cylinder—and also in two cylinder—locos. The re-arrangement gives a more uniform torque and a more regular draught than can be obtained with cranks set in ordinary fashion.

The re-arrangement of loco No. 449 has enabled it to easily haul heavy goods trains out of the difficult yard at Salisbury, which could not be done under the old arrangement. The re-arrangement has also proved equally satisfactory in handling passenger trains at speed.

* * * *

Electric Locos for Swiss Railway

An order has been placed in Geneva by a Swiss Railway Company for two large electric locos, each of 4,200 h.p. These locos, which are to be equipped with single-phase motors, will be the largest locos of this type and will be used for both goods and passenger traffic in the mountainous part of the Lötschberg Railway. Their normal speed will be 50 kilometers (about 30 miles) per hour, and their maximum speed 75 k. p.h. (about 45 miles). They are designed to haul loads of 560 tons on a gradient of 2.7% at a speed of 50 k. p.h. The locos will be of the 2–6–6–2 type and will be equipped with six twin motors, each of 700 h.p., with a total tractive effort at starting of 24 tons. The weight of the mechanical parts will be 67 tons, and of the electrical parts 68½ tons.

* * * *

Twenty Compound Locos for L.M.S.

At the L.M.S. Horwich works 20 four-cylinder super-heated passenger engines are being built, and it is expected they will be finished very shortly. The construction of twenty further locos will then be commenced. These latter will be of the 4–4–0 compound passenger type, of Midland design. They will be fitted with short chimneys, dome, and cab, to allow them to pass through all tunnels and under all bridges on the L.M.S. system.

* * * *

Rockley Viaduct

The Southern Railway reports the completion of the new viaduct at Rockley. The viaduct, which has a clear span of 130 ft., takes the place of an old viaduct of seven spans and is formed of three bow-string girders of the through type. The ends of the girders are supported on cylinders that were only sunk to a depth of 80 ft. in sandy strata after considerable difficulty. The total weight of steel work in the bridge is 500 tons.

In the tests made by the Railway Company before the bridge was opened, six different types of locos were run over the viaduct at speeds varying from a crawl to 79 miles per hour. At one time the bridge was called upon to bear the weight of three locomotives—nearly 400 tons!

* * * *

Over 400 miles of new branch line were opened during the past year by the Canadian Pacific Railway.

* * * *

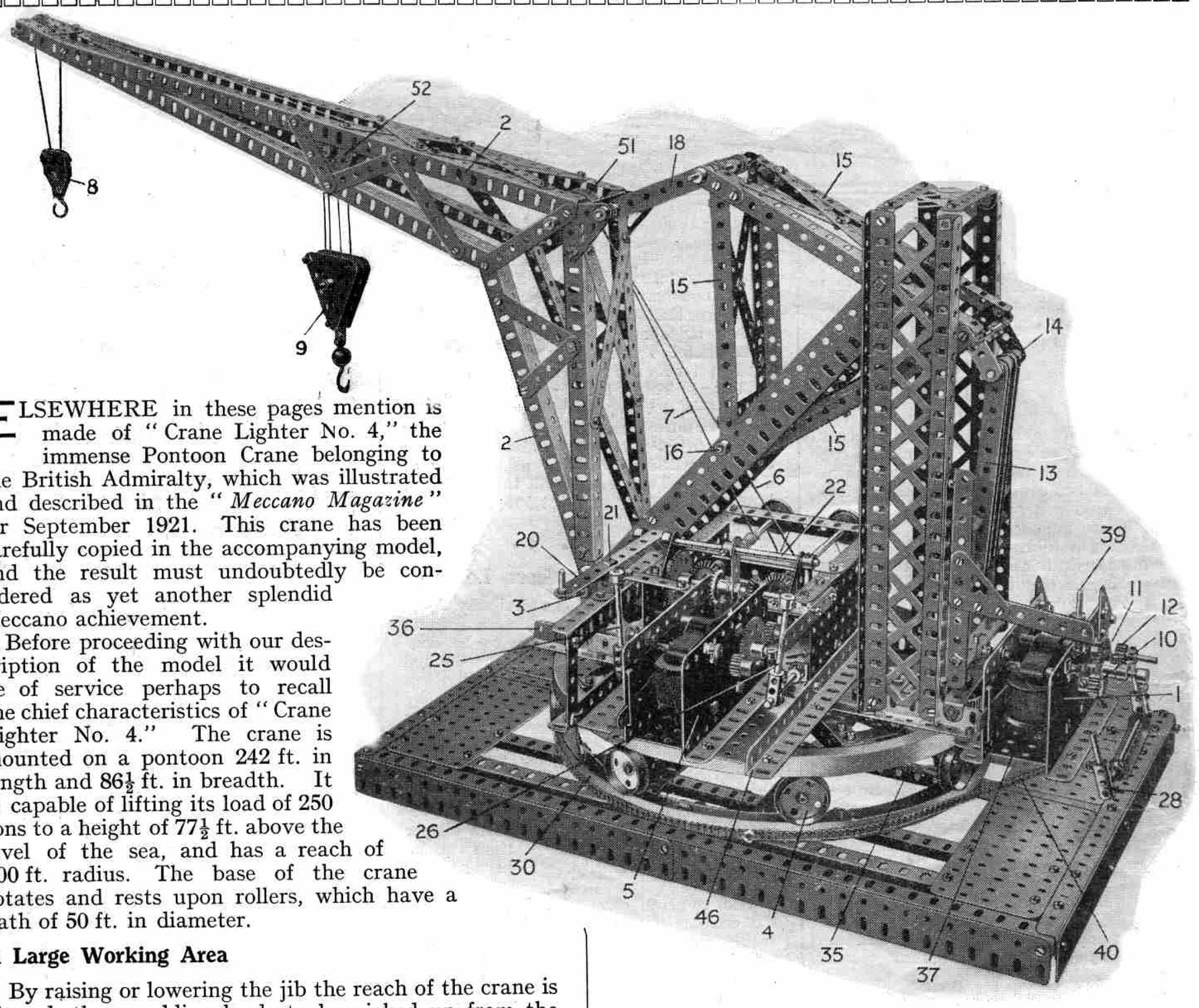
New Southern Rolling Stock

Two new corridor trains for service on the S.E. & C. section of the Southern Railway have recently been turned out from the carriage shops at Eastleigh. Each train consists of four first and third-class composites, two third-class and two third-class brake carriages.

The design of these carriages, which are part of an order for 77, follows the existing type, except that their width is 5¼" greater than previously. The carriages have corridors throughout and are intended for main line service. Incidentally, it is announced that stock 8 ft. 6 in. in width may now be run over practically the whole of the Southern Railway system.

A NEW MECCANO MODEL

PONTOON CRANE



ELSEWHERE in these pages mention is made of "Crane Lighter No. 4," the immense Pontoon Crane belonging to the British Admiralty, which was illustrated and described in the "*Meccano Magazine*" for September 1921. This crane has been carefully copied in the accompanying model, and the result must undoubtedly be considered as yet another splendid Meccano achievement.

Before proceeding with our description of the model it would be of service perhaps to recall the chief characteristics of "Crane Lighter No. 4." The crane is mounted on a pontoon 242 ft. in length and 86½ ft. in breadth. It is capable of lifting its load of 250 tons to a height of 77½ ft. above the level of the sea, and has a reach of 100 ft. radius. The base of the crane rotates and rests upon rollers, which have a path of 50 ft. in diameter.

A Large Working Area

By raising or lowering the jib the reach of the crane is altered, thus enabling loads to be picked up from the deck of the pontoon at, say, a reach of 50 ft., swung round and lowered into place at a reach of 100 ft. The crane, as erect as possible, picks up its load and swings round in line with the place where the load is to be dropped. The jib is then lowered, extending the reach of the load as it hangs, until it is immediately over the spot where it is finally deposited.

Hauling is accomplished by steel ropes, the maximum effort being made with the jib inclined at an angle of 40 or 45 degrees to the horizontal. When a heavy load is on, both steam and hydraulic brakes control the movements with wonderful precision.

The Meccano Model

Those of our readers of sufficiently long standing who are able to turn up "*M.M.*" No. 20 and compare the illustration on page 6 with our new Meccano model will be struck by the accuracy and realism of its reproduction in Meccano. Every movement of the original has not only been carefully copied, but identical methods are employed to bring about the required results, with the exception that in the Meccano model electricity takes the place of steam engines as the source of power. In this connection it may be mentioned that this model incorporates two electric motors—a unique arrangement that has not hitherto been introduced into any other published Meccano model. The two motors function quite separately from each other and are employed for entirely different purposes. The use of separate motors eliminates a great deal of gearing that would otherwise be necessary. Both the motors may, of course, be run off the same accumulator. The model is complete in every detail—the wonderful rocking-bar, giving great leverage and movement at the expenditure of the

minimum of effort—the graceful jib, with its two pulley blocks; the wheel and roller race, to minimise friction, and the screw mechanism—by which the jib is raised or lowered—perfectly demonstrated by the Meccano Threaded Rods.

We strongly advise every boy to build this fine model if possible, for it affords endless amusement as well as imparts very sound ideas on the general construction of giant cranes such as the one from which it is modelled.

Constructing the Model

The construction of the base, jib, etc., of the Crane may be clearly followed in the general view.

The wheel race (4) is identical to that used in the Hammerhead Crane and is clearly shown in the section of that model shown in Fig. B. It will be seen from this illustration that the lower race (30), formed of Channel Segments, is secured to the base, and an upper race (31) is bolted to the body of the model.

The spider frame (32) carries a series of Flanged Wheels (33), which run on the edges of the upper and lower races (30 and 31). Both the spider frame (32) and the upper race (31) swivel freely round a vertical Rod (34) which is secured in a Bush Wheel bolted to the centre 18½″ Angle Girder (35) in the base of the Crane. A Collar with set-screw should be placed on the Rod (34) above the Face Plate of the upper race (31). The spider frame (32) is shown in detail in Fig. A.

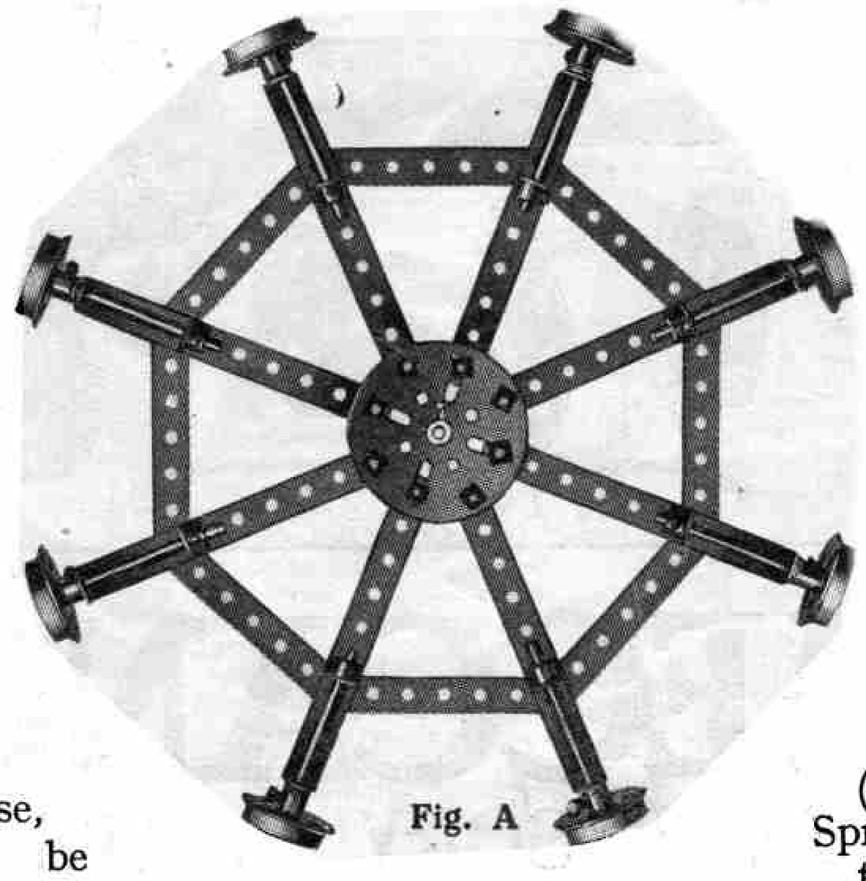


Fig. A

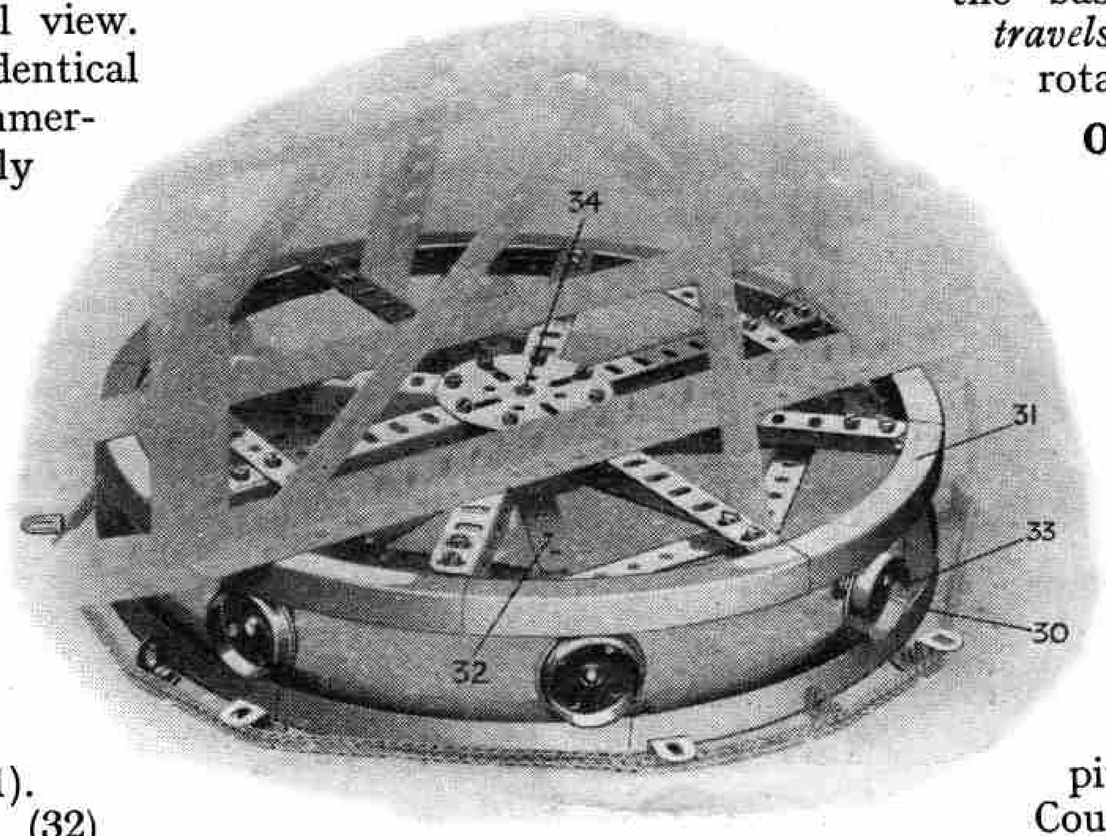


Fig. B

Rotating the Crane

Two 12½″ Angle Girders (36) are bolted to the upper race (31) and the 5½″ × 3½″ Flat Plate (37) secured in the last holes at one end of the Girders (36). This Plate (37) carries the Electric Motor (1) which drives a secondary Rod (2a Fig. C) by means of the Pinion (10) and Gear Wheel (11).

The Rod (2a) which carries a further Pinion (27), slides in its bearings, and is arranged so that on operation of the lever (28), it alternatively engages

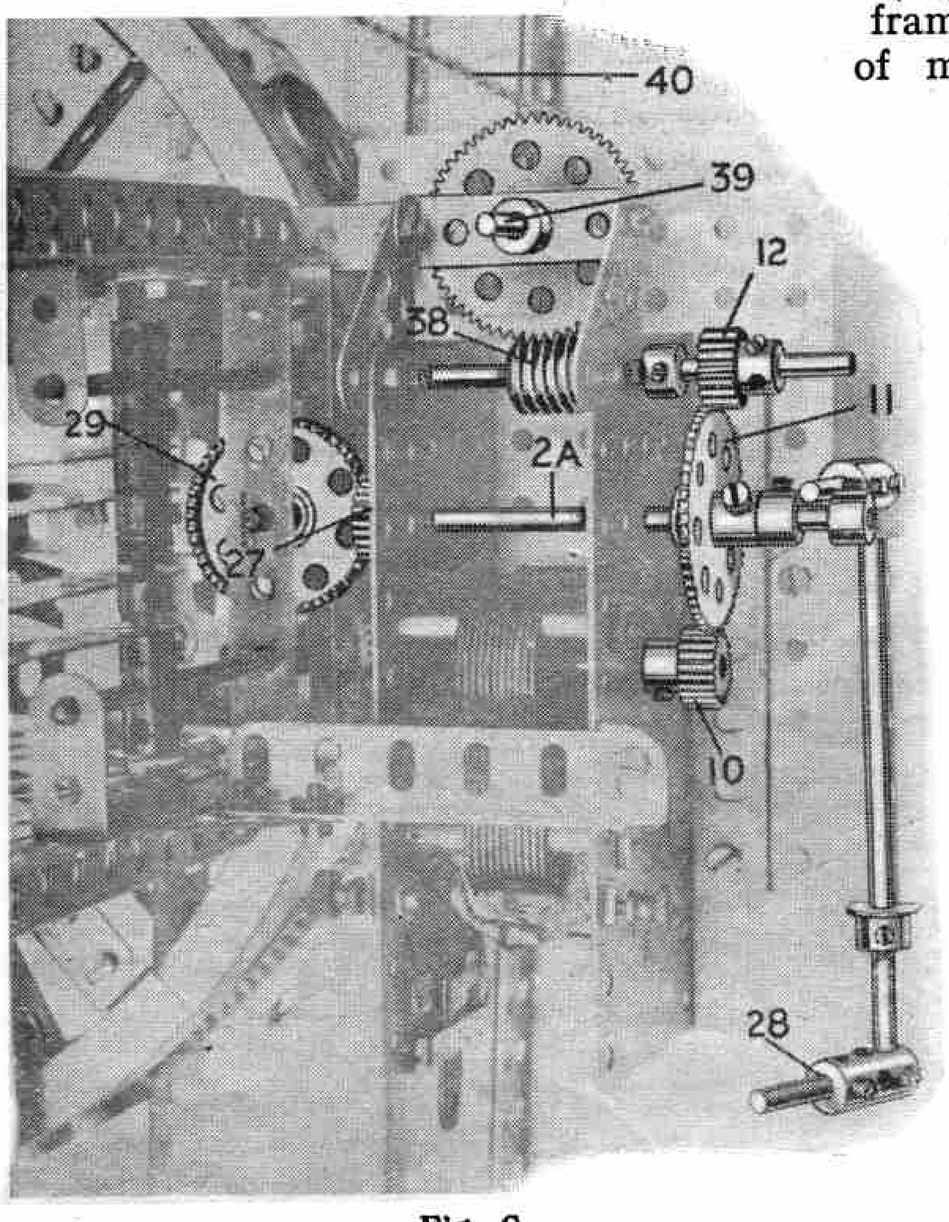


Fig. C

a Contrate Wheel (29) or the Pinion (12), although the Gear Wheel (11) remains constantly in mesh with the Motor Pinion (10).

A Worm Wheel (38) on the Rod of the Pinion (12) engages with a Gear Wheel on a vertical Rod (39).

On the lower end of the Rod (39) is mounted a 1″ Sprocket Wheel engaging the Sprocket Chain (40) which passes firmly round the lower fixed race (30). Thus by throwing the Gear (11) into mesh with the Pinion (12) the Sprocket Wheel on the Rod (39) is rotated, and since the Sprocket Chain (40) tends to grip the base (30) the Sprocket Wheel *travels round the Chain* (40), so rotating the Crane.

Operating the Jib

Now turn to Fig. F. The Contrate Wheel (29), which may be engaged by the Pinion (27), is mounted on a short Rod, to which a 1″ Gear Wheel (41) is secured also. The latter meshes with two other Gears (42 and 43) mounted on the Threaded Rods (44) on which are journalled Threaded Couplings (45)

Four 5½″ Strips (13) are pivotally connected to these Couplings and to the Rod (14) carried on the triangular framework (15, see general view of model).

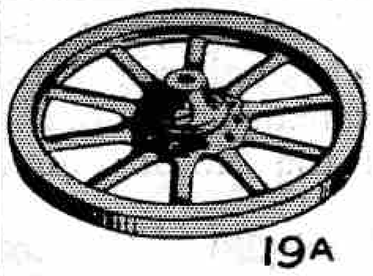
This framework (15) is pivoted at (16) and connected to the Jib (2) by the Links (18). The Jib (2) is mounted on a Rod (3, Fig. D).

It will now be seen that on moving the lever (28) so that the Pinion (27) is brought into gear with the Contrate (29), the Threaded Rods (44) are rotated and the Threaded Couplings (45) move up or down, according to the direction of the Motor (1), so causing the Jib to be elevated or lowered.

The Hoisting Blocks

The other Electric Motor (5) is mounted in a framework (46, Fig. E) formed by 9½″ Angle Girders bolted to Flanged Plates (47) which in turn are bolted to the transverse 12½″ Angle Girders (36). This motor

(*Continued on page* 125)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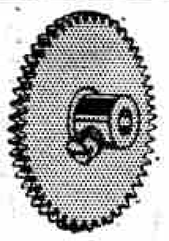
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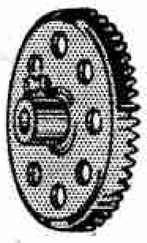
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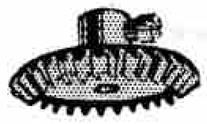
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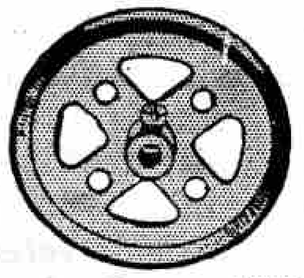
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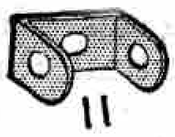
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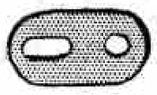
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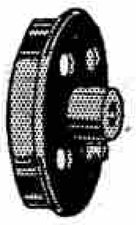
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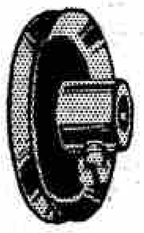
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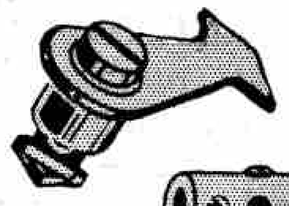
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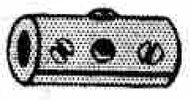
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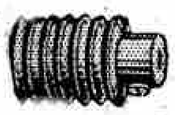
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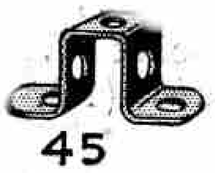
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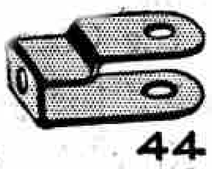
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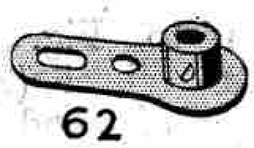
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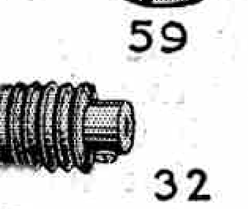
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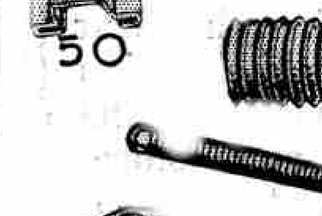
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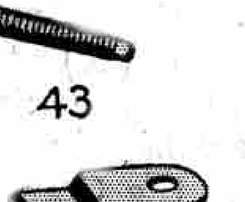
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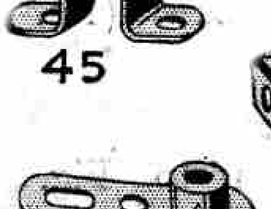
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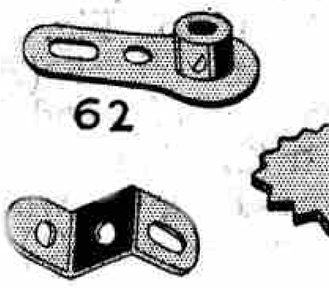
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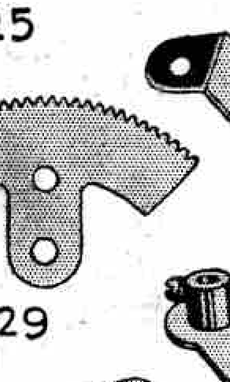
120A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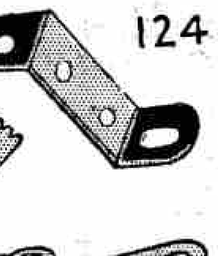
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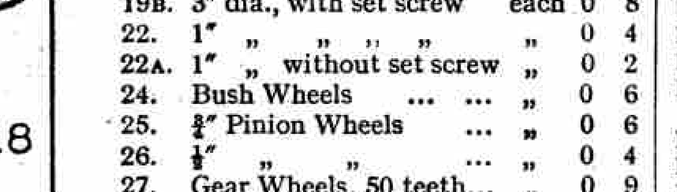
139A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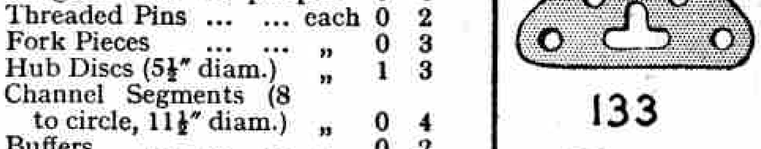
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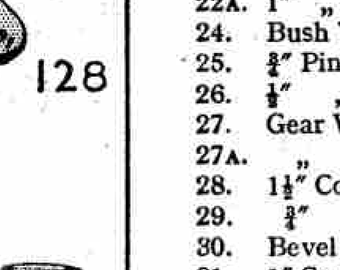
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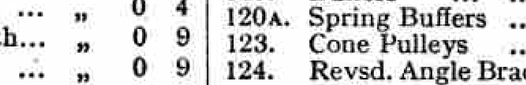
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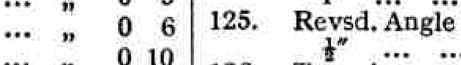
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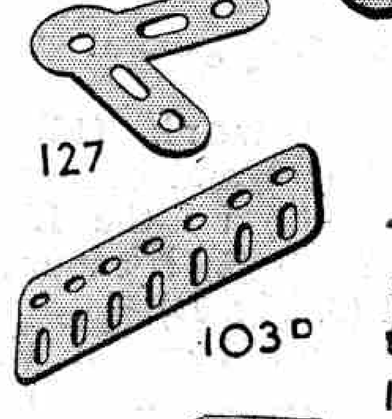
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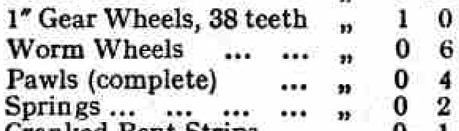
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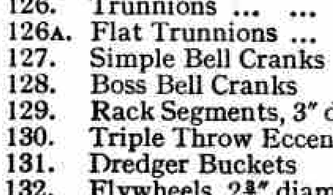
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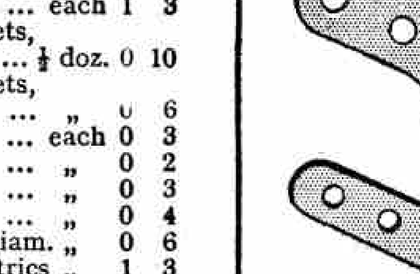
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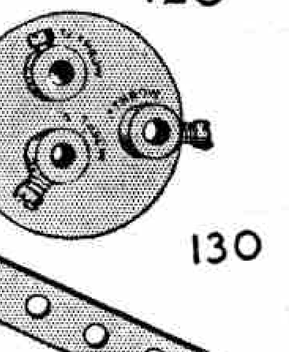

137

MECCANO

ACCESSORY PARTS

WE illustrate a selection of accessory parts that every Meccano boy will find useful in building the larger and more interesting models. Many of these parts have been only recently introduced, and although we know that they have a universal use (were it otherwise they would not have been added to the system) we may not yet know all their applications. There are endless possibilities in the employment of Meccano parts; indeed, we wonder if there is now a mechanical movement known to engineering that any boy cannot duplicate with Meccano.

		s.	d.
10.	Flat Brackets ... ...½ doz.	0	2
11.	Double Brackets ... ... each	0	1
12A.	Angle Brackets, 1" × 1" „	0	1
19A.	Wheels, 3", with set screw „	0	8
20.	Flanged Wheels ... ... „	0	6
	Pulley Wheels :		
19B.	3" dia., with set screw each	0	8
22.	1" „ „ „ „ „	0	4
22A.	1" „ without set screw „	0	2
24.	Bush Wheels ... ... „	0	6
25.	¾" Pinion Wheels ... „	0	6
26.	½" „ „ ... „	0	4
27.	Gear Wheels, 50 teeth... „	0	9
27A.	„ „ 57 „ ... „	0	9
28.	1½" Contrate Wheels ... „	0	9
29.	¾" „ „ ... „	0	6
30.	Bevel Gears ... ... „	0	10
31.	1" Gear Wheels, 38 teeth „	1	0
32.	Worm Wheels ... ... „	0	6
33.	Pawls (complete) ... „	0	4
43.	Springs ... ... „	0	2
44.	Cranked Bent Strips ... „	0	1
45.	Double Bent Strips ... „	0	1
50.	Eye Pieces ... ... „	0	2
57B.	Hooks (loaded) ... ... „	0	5
59.	Collars and Set Screws „	0	2
62.	Cranks ... ... „	0	3
63.	Couplings ... ... „	0	6
63A.	Octagonal Couplings ... „	0	8
63B.	Strip Couplings ... ... each	0	8
63C.	Threaded Couplings ... „	0	6
64.	Threaded Bosses ... „	0	2

		s.	d.
94.	Sprocket Chain per length	0	6
96.	Sprocket Wheels, 1" ... each	0	3
101.	Healds, for Looms ... doz.	0	9
108.	Architraves ... ... each	0	2
109.	Face Plates, 2½" diam. „	0	4
113.	Girder Frames ... ... „	0	2
114.	Hinges... ... ... per pair	0	4
115.	Threaded Pins ... ... each	0	2
116.	Fork Pieces ... ... „	0	3
118.	Hub Discs (5½" diam.) „	1	3
119.	Channel Segments (8 to circle, 11½" diam.) „	0	4
120.	Buffers ... ... „	0	2
120A.	Spring Buffers ... per pair	0	8
123.	Cone Pulleys ... ... each	1	3
124.	Revsd. Angle Brackets, 1" ... ...½ doz.	0	10
125.	Revsd. Angle Brackets, ½" ... ... „	0	6
126.	Trunnions ... ... each	0	3
126A.	Flat Trunnions ... ... „	0	2
127.	Simple Bell Cranks ... „	0	3
128.	Boss Bell Cranks ... „	0	4
129.	Rack Segments, 3" diam. „	0	6
130.	Triple Throw Eccentrics „	1	3
131.	Dredger Buckets ... „	0	2
132.	Flywheels, 2¾" diam.... „	2	3
133.	Corner Brackets... ... „	0	3
136.	Handrail Supports ... „	0	3
137.	Wheel Flanges ... ... „	0	4
138.	Ship's Funnels ... ... „	0	4
139.	Flanged Brackets, Right „	0	2
139A.	„ „ Left „	0	2
140.	Universal Couplings ... „	0	9
144.	Dog Clutch ... ... „	0	6

You may obtain Meccano Parts from your Dealer

The New Meccano Pontoon Crane—*(continued from page 123)*

drives through Bevels (19, 23 and 24) either one or other of the axles (48 and 49).

The change-over is effected by means of the lever (20) pivoted at (21) which slides a Rod (22), this in turn sliding the shaft carrying the Bevels (19) to which it is connected by a Crank (50). Thus if the lever (20) throws one of the Bevels (19) into gear with the Bevel (23) on the Rod (48), the Pulley Block (9) is raised or lowered by means of the cord (7) which passes over one of the 1″ Pulleys set between the two Bush Wheels (51) and over another Pulley similarly situated at (52); from there it is led to one of the Pulleys in the block (9), thence round the second Pulley at (52) and then over the second Pulley in the Block (9), finally being secured to one of the Bush Wheels at (52).

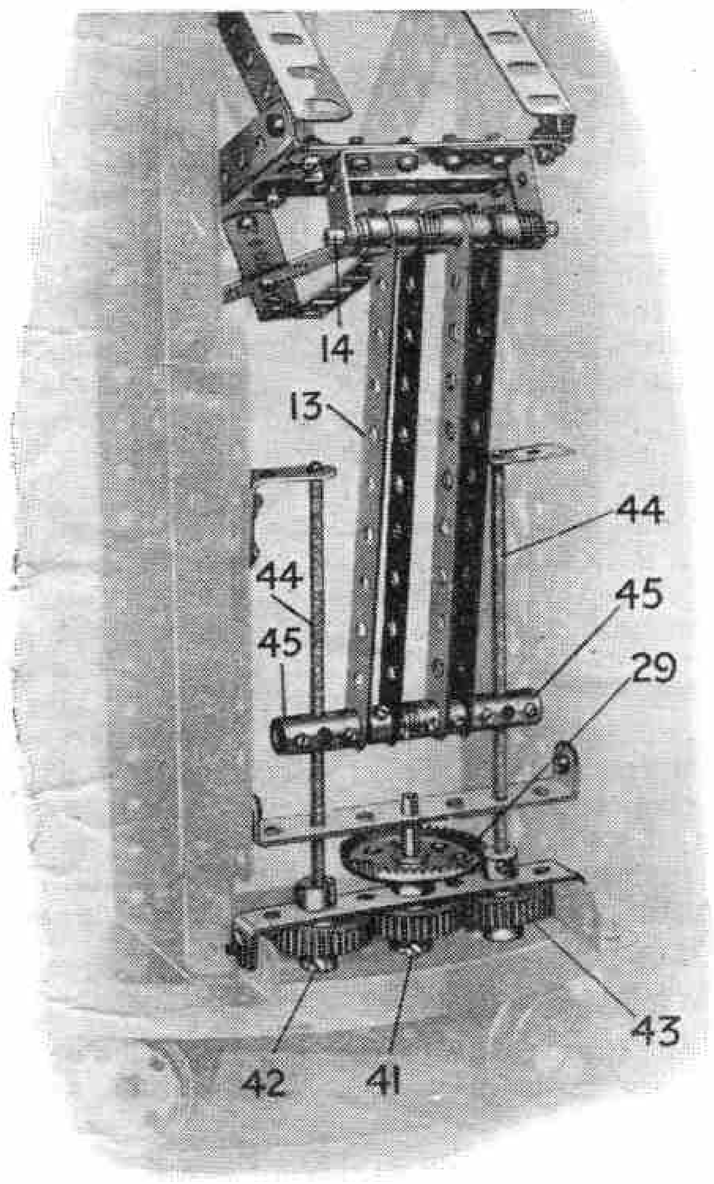


Fig. F

In a similar manner the Pulley Block (8) may be operated from the Rod (49), the cord (6) from which is led over the second Pulley at (51) to the Pulley in the end of the Jib (2); from there it passes over a ½″ Pulley in the Block (8) and is secured to the Jib (2).

The shafts (48 and 49) carry at their extreme ends two 1″ Pulleys, the grooves of which are gripped by cords tied to Cranks secured to two 8″ Rods arranged on either side of the Motor (5). These 8″ Rods carry Couplings and shorter Rods (25 and 26) which act as brake levers in controlling the loads on the Pulley Blocks (8 and 9).

List of parts required ;

12 of No. 2	1 of No. 17	1 of No. 53
11 „ „ 2A	3 „ „ 18A	1 „ „ 57
12 „ „ 3	8 „ „ 20	1 „ „ 57B
15 „ „ 4	2 „ „ 22	62 „ „ 59
4 „ „ 5	7 „ „ 22A	3 „ „ 62
1 „ „ 6	1 „ „ 23	6 „ „ 63
3 „ „ 6A	5 „ „ 24	4 „ „ 70
11 „ „ 7A	4 „ „ 26	3 „ „ 76
8 „ „ 8	5 „ „ 27A	2 „ „ 80
8 „ „ 8A	4 „ „ 30	1 „ „ 94
6 „ „ 8B	3 „ „ 31	1 „ „ 96
2 „ „ 9	1 „ „ 32	1 „ „ 97
10 „ „ 9A	135 „ „ 37	2 „ „ 99
1 „ „ 9B	58 „ „ 38	4 „ „ 103A
1 „ „ 9D	1 „ „ 40	4 „ „ 103B
4 „ „ 12A	1 „ „ 45	1 „ „ 103F
16 „ „ 12B	1 „ „ 48	3 „ „ 111
2 „ „ 13A	1 „ „ 48A	16 „ „ 119
2 „ „ 15	4 „ „ 48B	2 „ „ 126
5 „ „ 15A	2 „ „ 48D	2 „ „ 126A
6 „ „ 16	2 „ „ 52	5 „ „ 133
13 „ „ 16A	2 „ „ 52A	

NEXT MONTH:—

AUTOMATIC BAGATELLE TABLE

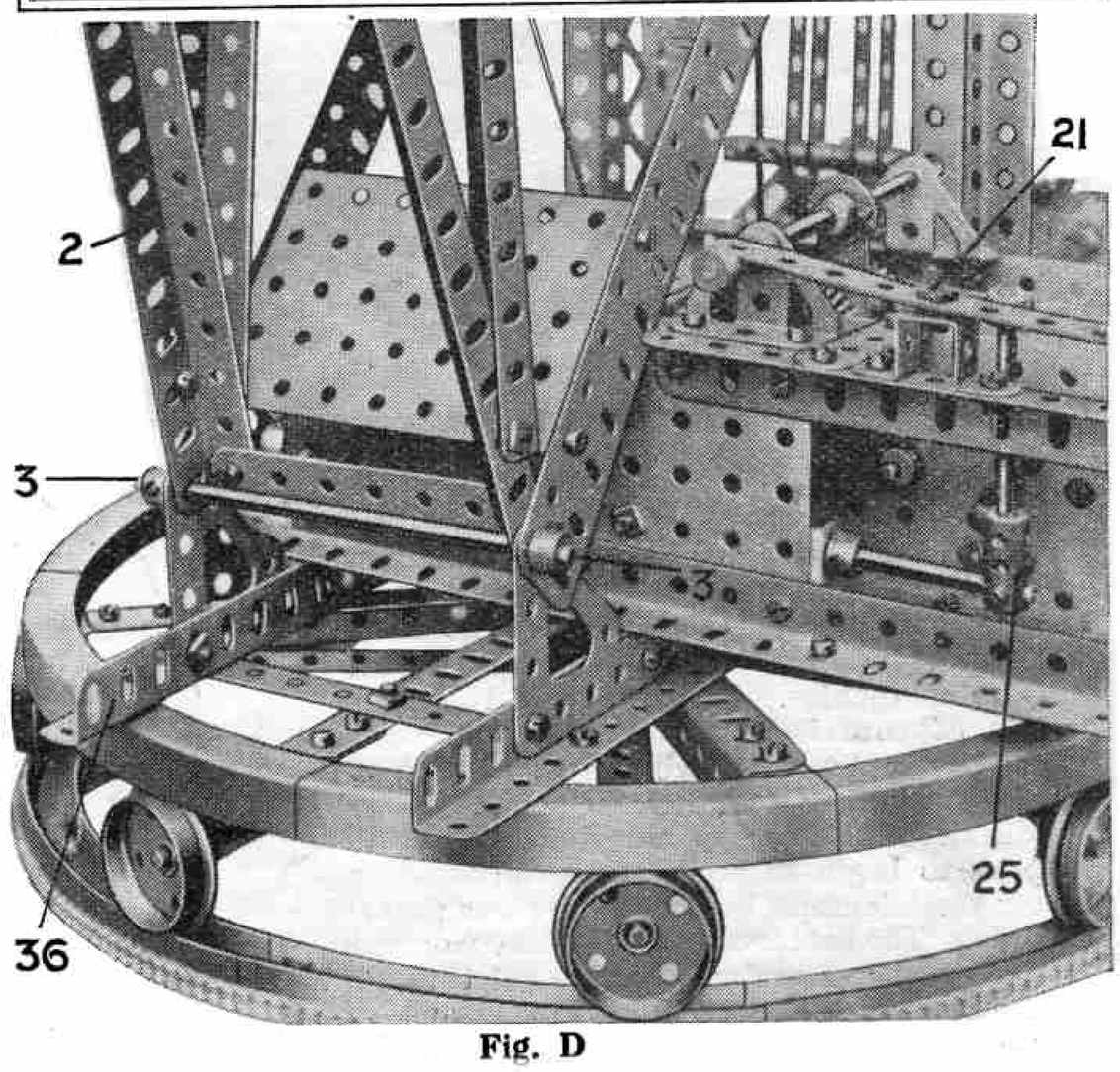


Fig. D

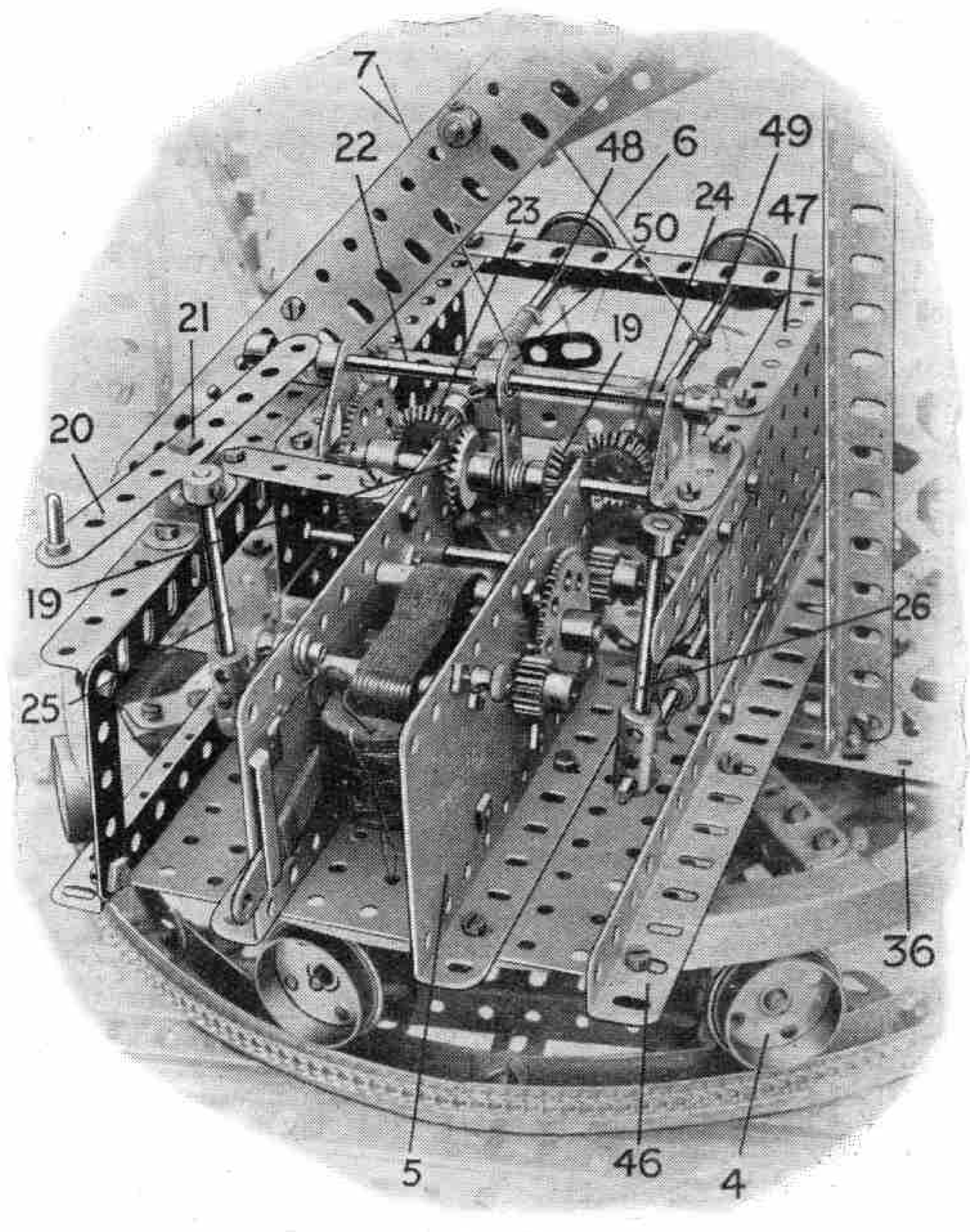
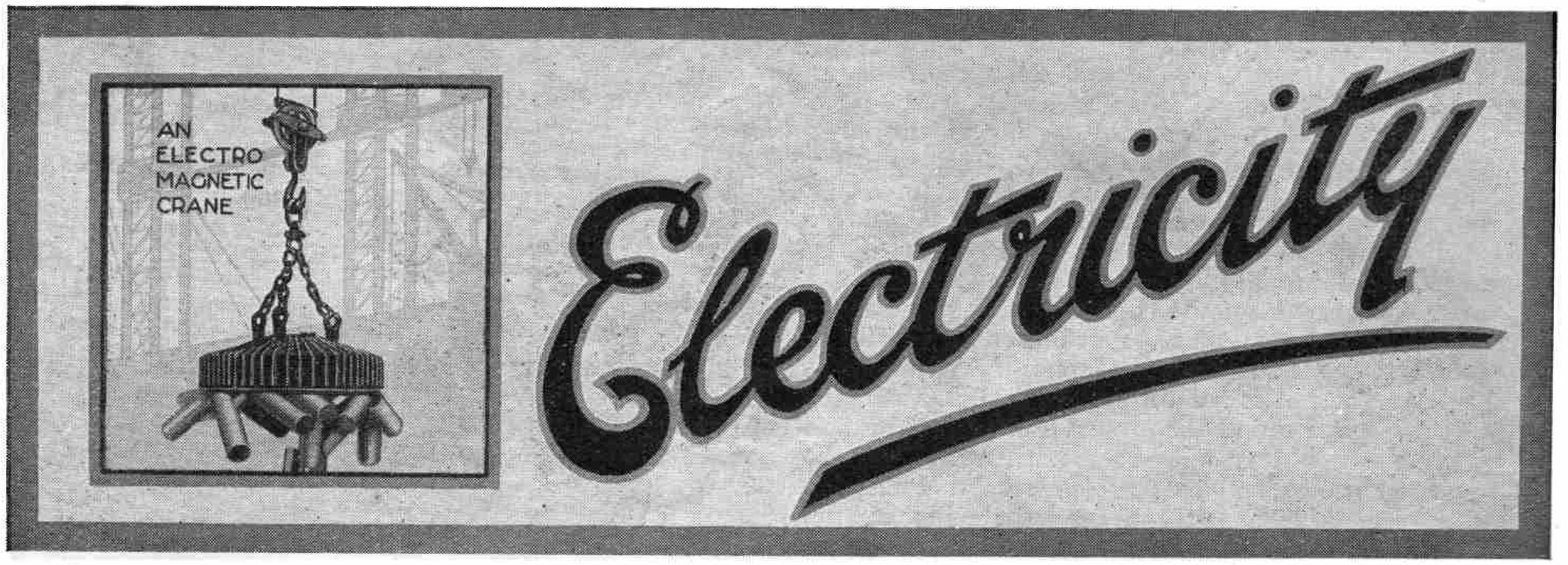


Fig. E



XIII. THE ELECTRIC TELEGRAPH

AT the beginning of 1920 there were over six million miles of telegraph wire in use throughout the world, not including wires reserved for the exclusive use of the railway companies. Nearly half of this huge length of wire is in Europe and one-third is in North America, while there are over 300,000 miles in Great Britain alone.

Consideration of these amazing figures will help us to begin to realise how important a factor the telegraph has become in our every-day life. The business man of to-day wonders how his predecessors managed to get through all their work when the quickest means of communication between any two places was by messenger, who, even in the most favourable circumstances, travelled on horseback. Without the telegraph the world's news would travel at what would now appear to be a snail's pace. For instance, we should not know the result of a cricket match played in Australia until several weeks after the game had been won and lost.

Early Attempts to Transmit Signals

It is interesting to read of the early attempts made to transmit signals by means of electricity, and to follow the path of progress up to the present day when six or seven different telegrams can be sent each way on one wire at once, and when a single wire can be used for telegraphing and telephoning at the same time.

Morse Code as used with Single-Needle Telegraph

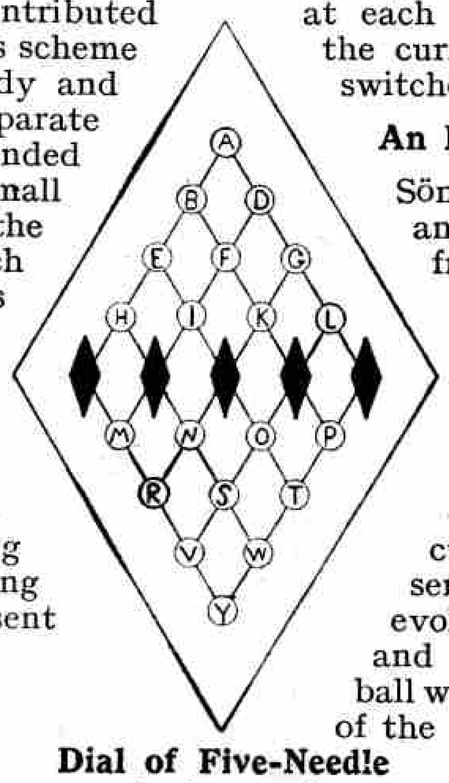
As early as 1727 it was known that an electric discharge could be transmitted to a considerable distance through a conducting substance such as a wire or a moistened thread, and this fact suggested the possibility of a method of electric signalling.

In 1753 a Scottish doctor named Charles Morrison contributed to "*Scott's Magazine*" an article outlining an ingenious scheme based upon the attraction between an electrified body and any light substance. His telegraph consisted of 26 separate parallel wires, each wire having a small metal ball suspended from it at each end. Close to each ball was placed a small piece of paper upon which was written a letter of the alphabet, the arrangement of the paper letters at each end of the wire being identical. The apparatus was worked by an electric machine. When any wire was charged with electricity the paper letters at each end of it were attracted towards the metal balls and in this way words and sentences were spelled out.

This system was interesting from an experimental point of view, but was of no use for practical purposes. Two of its greatest disadvantages were the cost of erecting 26 separate wires between each pair of communicating stations and the fact that messages could only be sent over a very short distance.

Signalling by Electric Shocks

Some 40 years later a Spaniard, Don Francisca Salva, announced before the Academy of Science at Barcelona, a scheme that was not only interesting but which contained many features of importance. Salva based his telegraph upon the fact that if wires were laid between two points, a man at one point holding the ends of the wires could be given a shock from a Leyden jar at the other point. Thus, by having 18 or 20 wires and the same number of Leyden jars, with a man holding each jar and representing a letter of the alphabet, it would be possible to transmit messages. Salva later suggested that the number of wires, jars and men could be reduced to six, or even less, by making each man interpret three or four different letters from the signals he received. Salva also proposed to insulate his wires and place them in a single cable, and he even suggested that such a cable might be laid under water—an anticipation of the submarine cable of to-day.



Dial of Five-Needle Instrument

A Chemical Telegraph

With the invention of the voltaic cell, inventors' ideas took a new direction and several telegraphs were quickly proposed. One of the most interesting of these was that of a Bavarian named Sömmering, which made use of the discovery that an electric current could decompose water. As we explained in the June 1924 issue of the "*M.M.*," if two metal strips are placed in water to which a small amount of acid has been added, and are then connected to an electric battery, the water is decomposed into its constituents, oxygen and hydrogen. Oxygen is formed at the strip connected to the positive pole of the battery and hydrogen at the other strip, and the formation of these gases is indicated by streams of small bubbles appearing at each strip. The bubbles commence to form immediately the current is switched on and they cease immediately it is switched off.

An Ingenious Contrivance

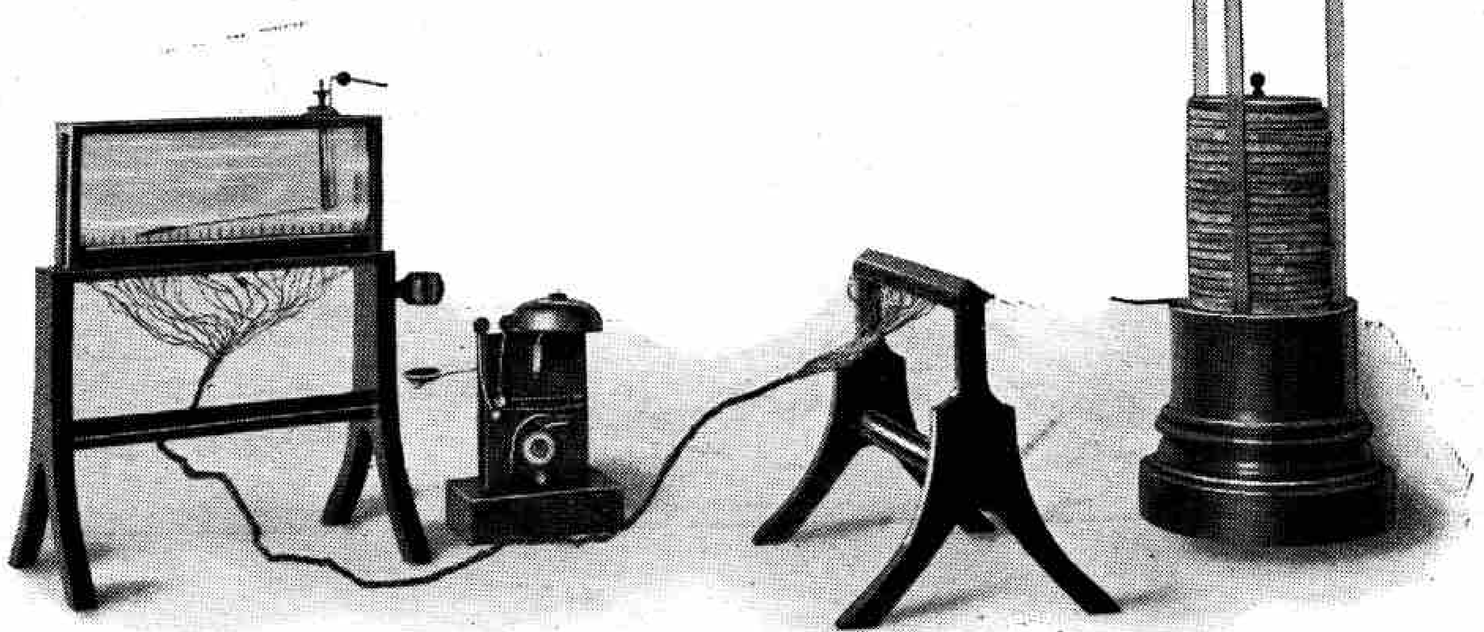
Sömmering's apparatus consisted of 35 wires, for letters and numbers, each connected to a gold pin projecting from below into a glass vessel filled with acidulated water. When the current was sent along any particular wire, bubbles of gas formed at the pin at the end of it and so a letter or number was indicated. A very ingenious contrivance in Sömmering's chemical telegraph enabled the attention of the receiving operator to be attracted at any time. The pin at the end of one particular wire was fitted with a sort of inverted cup attached to a lever. When the sending operator sent a current through this particular circuit. gas was evolved from the pin and filled the cup, causing it to rise, and this movement lifted the lever and released a metal ball which fell upon a small gong and so attracted the attention of the receiving operator.

It is very interesting to arrange an experimental telegraph on the lines of Sömmering's scheme. There

is no difficulty in doing this and a great deal of fun may be had from a simple chemical telegraph of this kind.

Wheatstone and Cooke, Morse and Steinheil

Sömmering's telegraph, like its predecessors, never came into practical use, and little or no progress was made until 1819, when the Danish scientist Oersted discovered that a magnetised needle could be deflected by a current of electricity flowing through a wire held over the needle. This discovery laid the foundation of the first really practical telegraph, but progress was delayed for some years on account of the fact that the existing forms of voltaic cells polarised so rapidly that it was impossible to obtain from them a constant current. The invention of the Daniel cell removed the difficulty in this respect, for this cell gave a steady current, as was explained in the June 1924 "*M.M.*"



Copyright] [*S.I.B.*

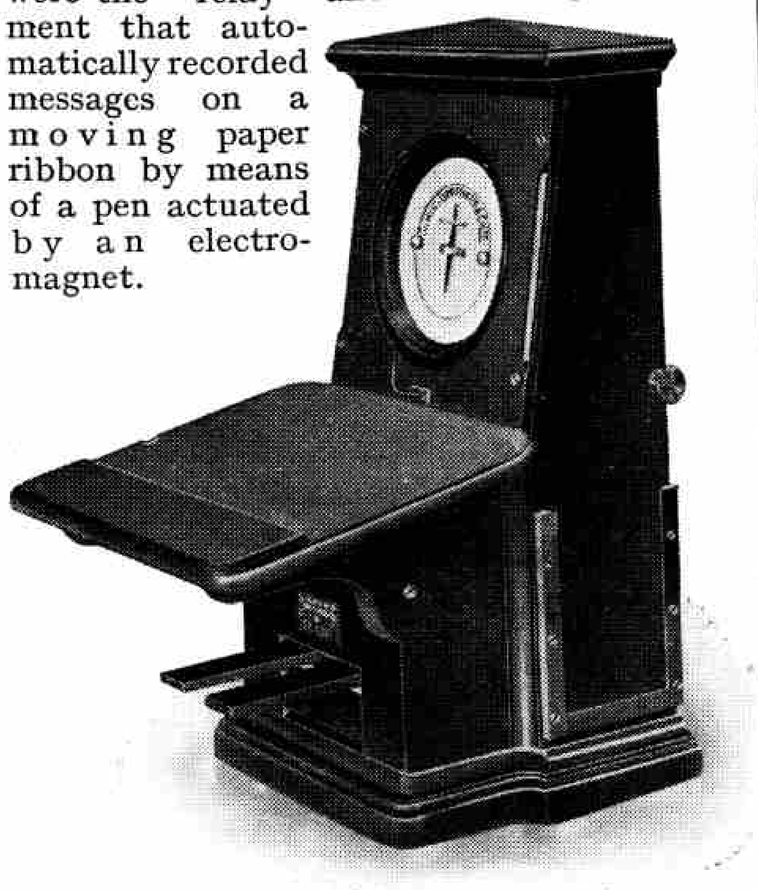
Sömmering's Chemical Telegraph Apparatus

About the year 1837 three separate practical telegraphs were produced—by Morse in the United States, by Wheatstone and Cooke in England, and by Steinheil in Germany.

Five-Needle Instrument

The first telegraph of Wheatstone and Cooke consisted of five magnetic needles pivoted on a vertical dial on which the letters of the alphabet were marked. The needles were deflected as required by currents made to flow along wires when certain keys were depressed, in such a manner that two needles would point towards the required letter. This telegraph was tried with success on the London and North Western Railway over a wire a mile and a half long. Wheatstone and Cooke subsequently invented a single-needle telegraph in which the letters were indicated by movements of the needle to the right or to the left, according to the direction of the current sent through a coil of wire.

In the United States Morse had devised a scheme of telegraphy in 1832, but it was not until five years later that he got his apparatus into working order. He was an artist by profession, but was not very successful, and for a long time lack of money prevented him from developing his telegraph. Ultimately he succeeded in obtaining a State grant for the construction of a telegraph line between Baltimore and Washington, and the first message over this line was sent in 1844. Morse also devised a telegraphic code which is practically the same as that in use throughout the world to-day. Among the most interesting features of Morse's telegraph were the "relay" and a receiving instrument that automatically recorded messages on a moving paper ribbon by means of a pen actuated by an electro-magnet.



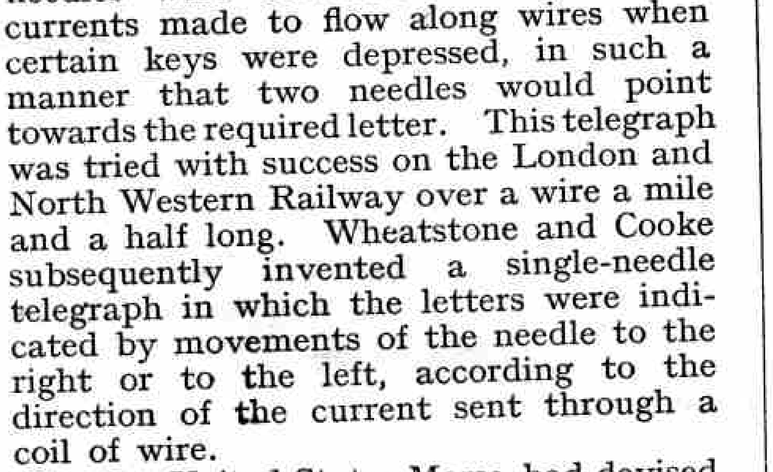
Courtesy] [*Messrs. Siemens Bros. & Co. Ltd.*

Single-Needle Telegraph

Steinheil, a German, made the very valuable discovery that a second wire for the return of the electric current was not necessary, and that the earth itself could be used for the return part of the circuit.

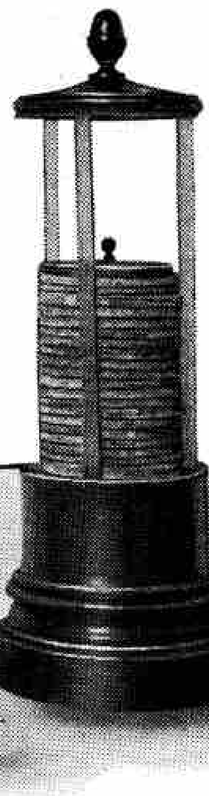
Telegraph proves its Value

The electric telegraph, like many other great inventions, was treated by the general public for a long time with utter indifference. In England no one had a good word for the telegraph until its use made possible the capture of a murderer who otherwise would have escaped. The crime was committed near Slough, and the murderer succeeded in taking train for London. Fortunately the Great Western Railway had a telegraph line between Slough and London, and a description telegraphed to Paddington enabled the police to arrest the murderer on his arrival. In the United States the indifference was equally marked. The rate for messages on the line between Washington and Baltimore was one cent. for four words, and the total amount taken during the first four days was one cent.!



Courtesy] [*Messrs. Siemens Bros. & Co. Ltd.*

Transmitting Key



[*S.I.B.*

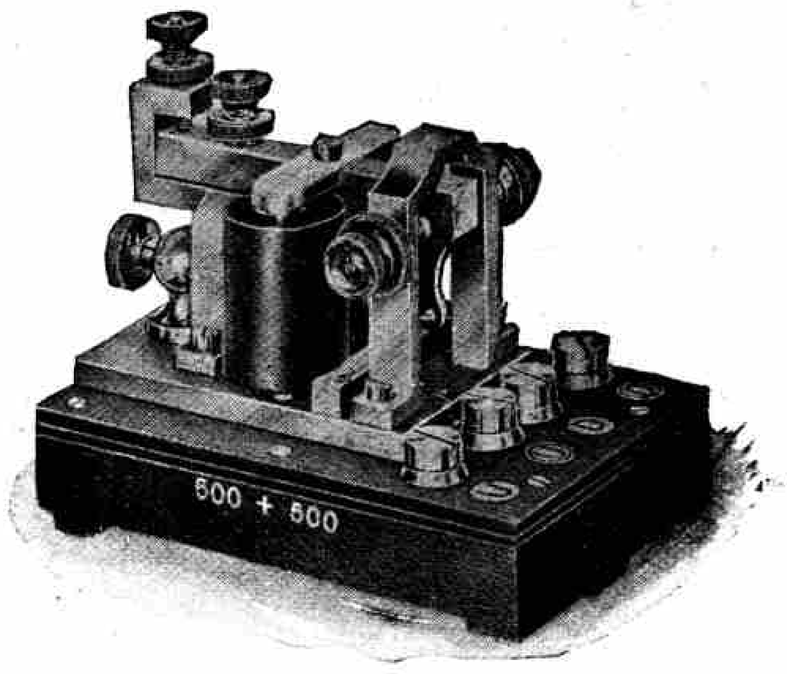
Single-Needle Instrument

The single needle instrument is one of the simplest forms of telegraph. It consists essentially of a magnetic needle fixed to a spindle at the back of a vertical board through which the spindle passes. On the same spindle, but in front of the board, is fixed a dial needle which moves along with the magnetic needle behind. A coil of wire passes round the magnetic needle and this is connected to a "commutator" for reversing the direction of the current. The current is made to flow through the coil by turning a handle, and upon the direction in which the handle is turned depends the direction of the current and consequently the direction in which the needle will move. Two keys may be used instead of a handle, the movements of the needle depending upon which key is pressed. With this instrument the Morse code with its combination of dots and dashes is used, a movement of the dial needle to the left signifying a dot and a movement to the right a dash. The code as used in the single-needle instrument is shown on page 126. With this instrument a good operator can transmit messages at the rate of about twenty words a minute.

The "Sounder"

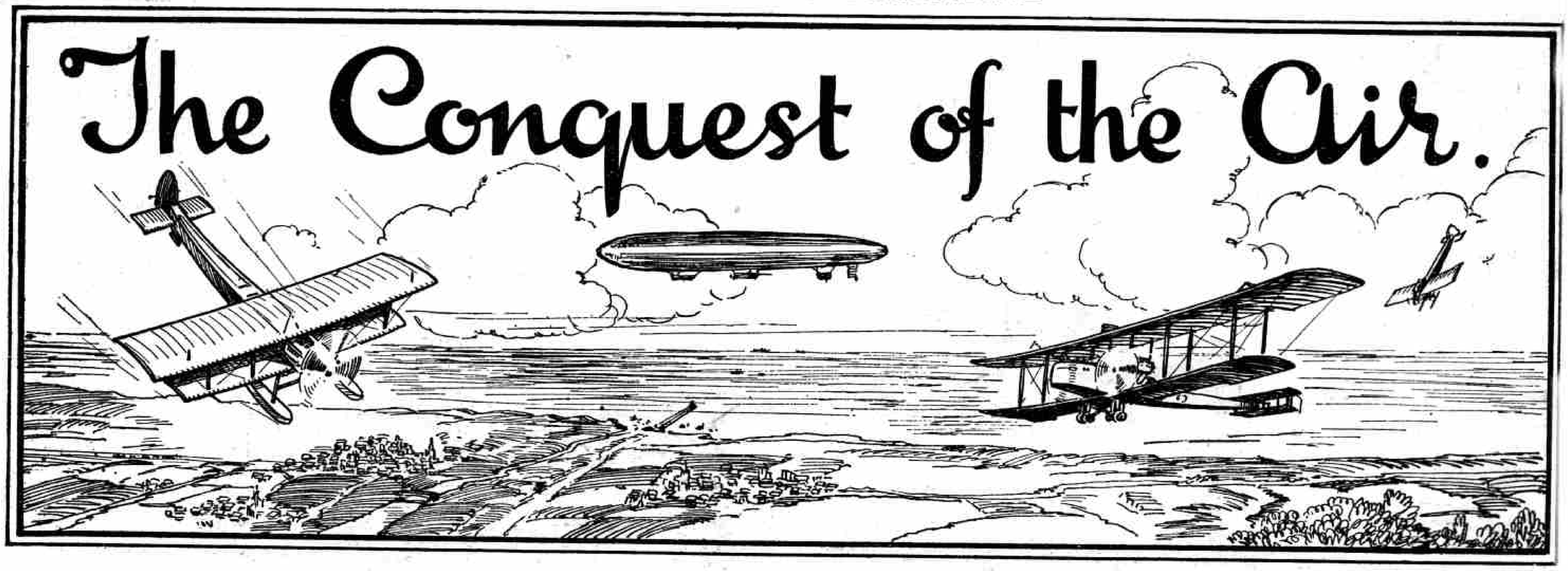
The single-needle instrument in a modified form is used for messages between signal cabins on railways, but for telegraphic work in general an instrument called the "Morse sounder" is used. The sounder consists of an electro-magnet which, when a current flows round it, attracts a small piece of iron fixed at one end of a pivoted lever, the other end of which moves between two stops. The sending operator closes a battery circuit by pressing a key. The electro-magnet of the sounder at the receiving station then attracts the iron and the lever flies from one stop to the other with a sharp click, returning

(*Continued on page* 140)



Courtesy] [*Messrs. Siemens Bros. & Co. Ltd.*

Sounder



I. THE LYMPNE TRIAL FOR LIGHT MONOPLANES

DURING the past year or two so much has been written about the giants of the air—the huge bombing-planes of the Air Force and the passenger-carrying machines of the Cross-Channel Service—that the amazing development in the other extreme has been almost overshadowed. To many people the coming of the light monoplane remained almost unnoticed until a few months ago, when their attention was drawn to the matter by the trials at Lympne. These trials, for two-seater light aeroplanes, were initiated by the Air Ministry and endowed with prizes totalling nearly £4,000.

In our future issues we hope to give some description of the remarkable light monoplanes that took part in these trials, and this month we commence this series with some account of the winner of the trials, the Beardmore light monoplane "*Wee Bee I*," fitted with a Bristol "Cherub" two-cylinder air-cooled engine.

Contests Designed to Encourage Slow Planes

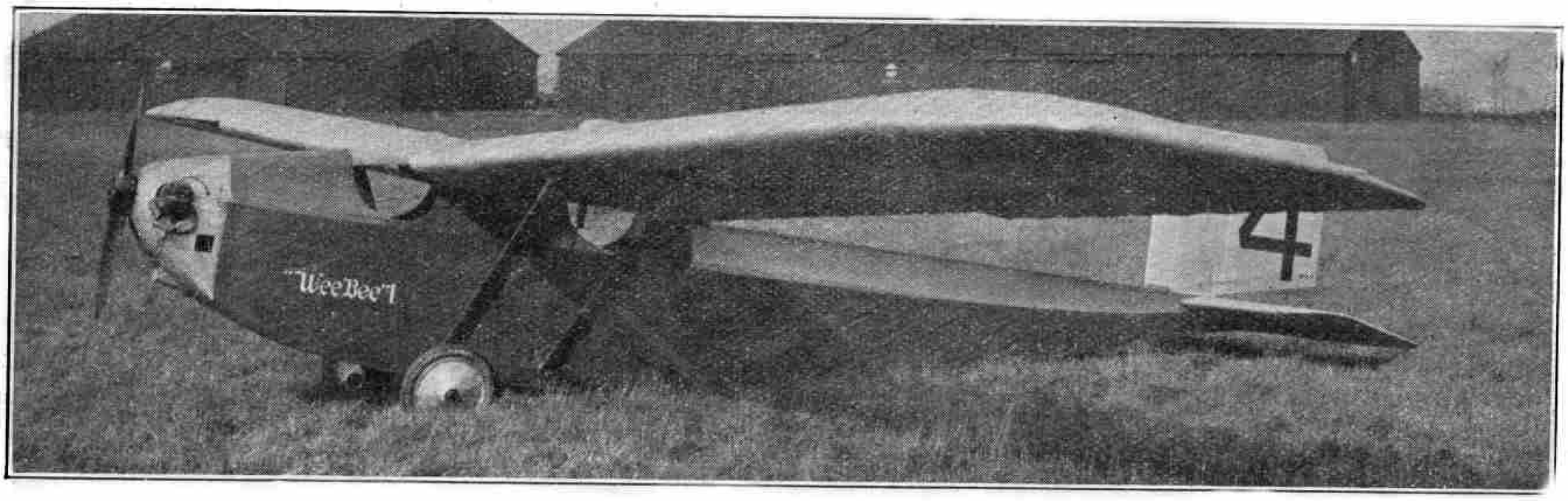
The main object of the Lympne competition was to encourage the production of two-seater aeroplanes with engines not exceeding 1,100 c.c. and those low in first cost and economical in operation. It was considered that the desirable qualities in such machines were those that would be found in aeroplanes having a wide range of speed. That is to say, aeroplanes capable of a fairly high maximum speed and yet able to land sufficiently slowly to avoid the risk usually associated with the landing of very fast machines. Consequently, the rules of the competition were drafted so as to encourage the slow rather than the fast aeroplane. Thus it was that the basis of the award of marks in the speed range competition was a special formula that gave a high figure to the aeroplane showing the greatest flexibility between high and low speeds.

Those of our readers who are keen on maths. will be interested to learn that this formula was $\frac{V-v}{v}$ where V is the maximum speed and v the minimum speed at which the machine is able to fly. It was stipulated that no marks would be awarded for a speed range of less than $33\frac{1}{3}$ per cent. and that eight marks be awarded for each per cent. above $33\frac{1}{3}$ per cent., expressed as a percentage of the slow speed.

In addition to the speed-range tests there were tests for quickness in getting-off and in alighting. In the former, one mark was awarded for each yard by which the distance required to clear a barrier 25 ft. in height was less than 450 yards. In the latter, one mark was awarded for each yard by which the distance from a 6 ft. barrier—over which the machines had to alight—was less than 150 yards, measured from the centre of the barrier to the centre of the wheels of the aeroplane's undercarriage.

Cash Prizes of £4,000

In order to be eligible for the various prizes, competing machines had to accomplish at least ten hours' flying during the competitions. Only certain parts of machines and engines were permitted to be changed or replaced, otherwise competitors were required to start all over again. The high-speed course was triangular, the complete circuit measuring $12\frac{1}{2}$ miles. Competitors



The Monoplane at rest at the Lympne Trials

Photo courtesy "The Aeroplane"

were required to fly five laps (62½ miles) without landing, then alight to fill up with petrol and oil only, and then fly another five laps. The remaining tests were carried out over the aerodrome.

The following prizes were offered :

A first prize of £2,000 and a second prize of £1,000 by the Air Ministry for the highest and next highest number of marks awarded in the speed-range, getting-off and pulling-up tests.

£500 by the Duke of Sutherland for the best performance in the getting-off and pulling-up tests.

£100 by Capt. C. B. Wilson, M.C., for the next best performance in getting-off and alighting.

£150 each by the Society of Motor Manufacturers and Traders and by the British Cycle and Motor-Cycle Manufacturers' and Traders' Union for the greatest number of laps flown over the triangular course.

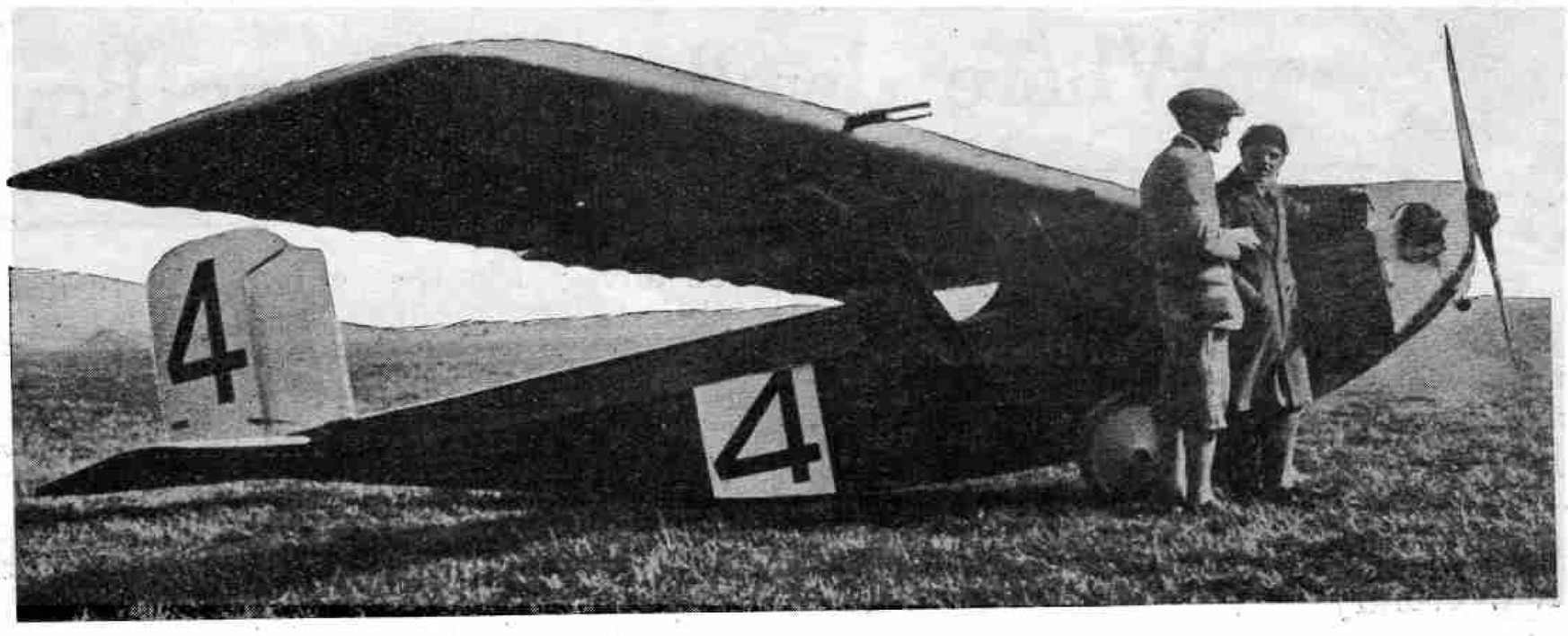


Photo courtesy] [*Messrs. Wm. Beardmore & Co. Ltd.*

"Wee Bee I," with her designer, Mr. W. S. Shackleton (on left), and Pilot, Mr. M. W. Piercey

"Wee Bee I" Holds its Own

During the eliminating trials, the competitors were required to dismantle and re-erect their machines within two hours. They also had to fly two circuits of the course, one with the pilot occupying the front seat and one in which he sat in the rear cockpit (in order to demonstrate that the machine could be flown from either cockpit). It is surprising to learn that 10 out of the 18 machines entered failed to satisfy the preliminary conditions.

On the opening day of the competition, "*Wee Bee I*," piloted by Mr. M. W. Piercey, was the first machine to complete the prescribed ten laps of the high-speed course. Although not running at full throttle, the "Cherub" established what remained to the end of the competitions the highest speed. This was slightly over 70 miles per hour.

"*Wee Bee I*" had proved herself to be very fast, but it was generally expected that some of the other machines would score in the slow speed tests. But here also the "*Wee Bee I*" proved able to hold her own, for during the first set of low-speed tests Piercey actually flew her at 40.67 m.p.h., nearly 1 m.p.h. slower than the next-best performance on that day. Later in the week this speed was further reduced to 39.66 m.p.h. gaining for the Beardmore 347.52 marks for speed range.

In the take-off and pull-up competitions the "*Wee Bee I*" did very well, its best take-off being one of 235 yards, while it pulled up in 124 yards.

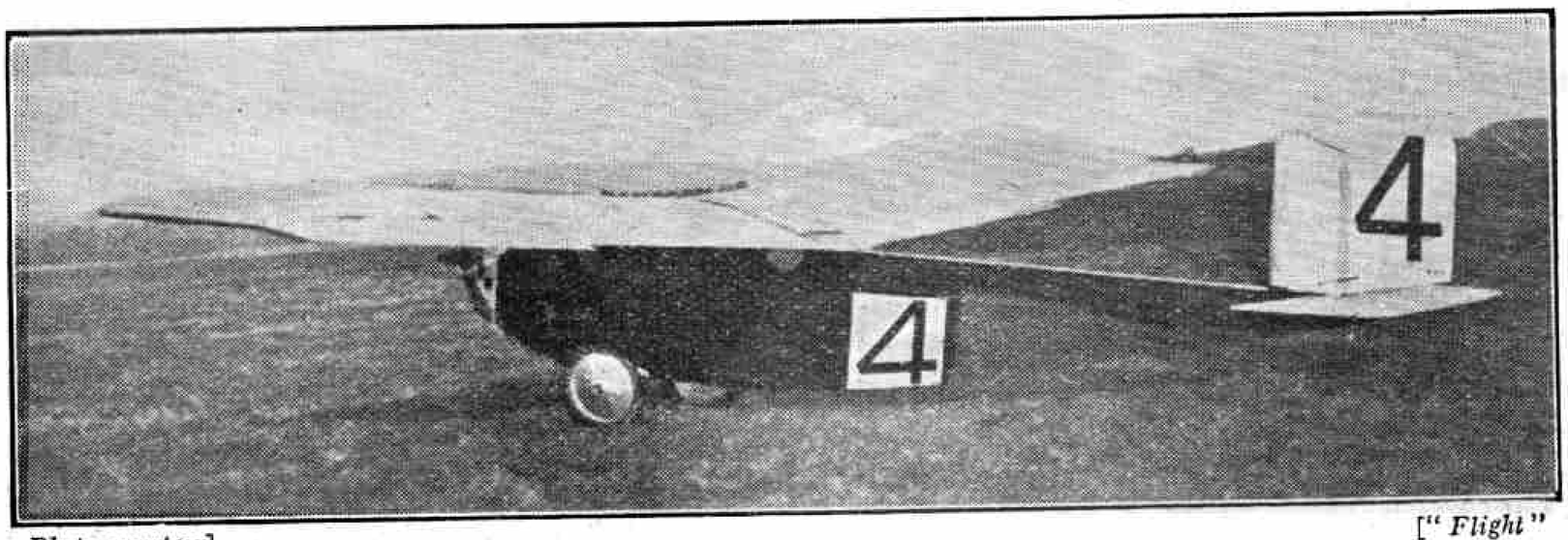


Photo courtesy] ["*Flight*"

The "Wee Bee I" getting its tail up at the start of a test

Engine Trouble at 80 m.p.h.

During the Lympne week many competitors experienced engine trouble, and in this respect the "*Wee Bee I*" had no better luck than many of the others. In fact she had very hard luck, for when Piercey was within two miles of the finish of a high-speed test, which would have placed him far beyond the reach of any rival, he experienced trouble of so serious a nature that he had to land.

About the middle of the week, while Piercey was cruising around the course in order to put in his ten hours' flying, he noticed that his engine revs. began to drop. Upon examination, it was found that a small oil spray pipe in the top of the crank case had become choked. In consequence, the big-ends were not being lubricated and indeed one big-end had heated up considerably. As it was not permitted to change such parts in the engine, except at the penalty of having to start the trials all over again, the pilot decided to "nurse" the engine during the remainder of the competition.

For several days there did not appear to be any likelihood of "*Wee Bee's*" leading position being threatened, but on the last day of the competition there seemed to be a chance of another competitor lifting the prize. This tempted Piercey to go out again in order to do another high-speed test, for he knew that the 70.11 m.p.h. he had already registered did not represent anything like the actual top-speed of "*Wee Bee I*," which is in the neighbourhood of 87 m.p.h. That this was the case was shown by the fact that the first five laps were covered at a speed of nearly 80 m.p.h., as were also the first four laps of the second set of five. On

(*Continued on page* 131)

Dick's visit to MECCANOLAND

Where dwell the Happy Boys

MOST people by now have heard of the wonderful new country where nearly all the inhabitants are boys—millions of them; the land where all is sunshine and joy; where no strife or dissension comes to mar the happy hours; where harmony and good-fellowship reign supreme.

A Wonderful New Country

All the inhabitants of this sunny realm are happy and joyous, crowding the fleeting hours with pleasure and fun. The young ones are enjoying themselves amongst miniature Bridges, Wagons, Windmills, Trucks and Towers—exquisite engineering models, which they have built and set to work mechanically. The older ones are building and playing with larger structures, Giant Cranes, Draglines, ingenious Looms for real weaving, Clocks that keep time, Automobiles with real gears, and hundreds of other models, all equally interesting and fascinating. The more thoughtful and serious boys are busily engaged in inventing and creating new and ingenious models and movements.

This happy country is called Meccanoland, and boys from every part of the world live there. Meccano language is the universal boy-language, and all the inhabitants understand and speak it. They have their own magazine, which deals with topics that Meccano boys love to read about; they have their own Guilds and Clubs; and they spend happy hours in friendly rivalry, each striving to build better and invent more than any of the others.

The Land of Happy Boys

Some boys have lived in Meccanoland for more than twenty years, and the longer they live there the happier they are. Every day more boys are crowding into the country, eager to learn of its wonders. The moment they arrive they feel at home, and they take their places and set to work with a will. They know that in Meccanoland they will have the time of their lives; that they will have more fun than they have ever had before. Meccano fun is healthy boys' fun—fun that makes them glad to be alive; fun that strengthens their characters, sets their brains working, and teaches them something that will make them into successful men.

The sun never sets on Meccanoland, where there is always life and joy. The gates are never closed, and the only passport you require to enter this wonderful land is a Meccano Outfit. Get your passports to-day, boys, and don't stay another minute in the cold dreary world outside.

A short time ago a bright eager boy heard about Meccano and Meccanoland, and he told his father about them. His father was so interested that he called at the Meccanoland Home Office to investigate, and what they told him there so impressed him that he set it all down. You will find it in this article, and when you have read it through you will agree that you have never read anything so absorbing.

The Spell of a Wonderful Toy

"Are you ready, Dad? Now watch—I'm going to show you something!"

"My word, Dad, it's great!" cried Dick, as he came running into my room with a parcel under his arm.

"What is great?" I asked, looking up from my paper.

"Why, Alan's Meccanograph. He has got . . . ."

"Alan's what did you say? What is a Meccanograph?"

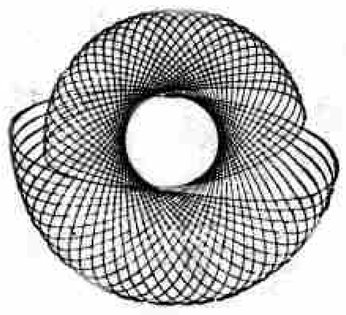
"Well, I'm trying to tell you. Last Christmas, Alan got a Meccano Outfit—the engineering toy that you see advertised in all the papers. He built a most topping lot of models—a big Bridge, a Crane, a Motor Chassis, and I don't know how many more besides. Then he wanted some more parts to make bigger models. His father wouldn't hear of it at first, but said that if Alan would make a really clever model with the parts he already had, he'd buy him the parts he wanted."

"Did he do it?" I asked, becoming interested.

"Rather! Why, he made the Meccanograph, and he's lent it to me. Here it is!"

Dick placed his parcel on the table, took off the wrappings and disclosed a neat mechanical contrivance, with a little crank at one end and a wooden platform at the other.

"Lend me your fountain pen, Dad," said Dick. I did so, and he fixed it into the machine so that the



point rested on a piece of paper, which he pinned on the little platform.

"Are you ready, Dad? . . . Now watch—I'm going to show you something."

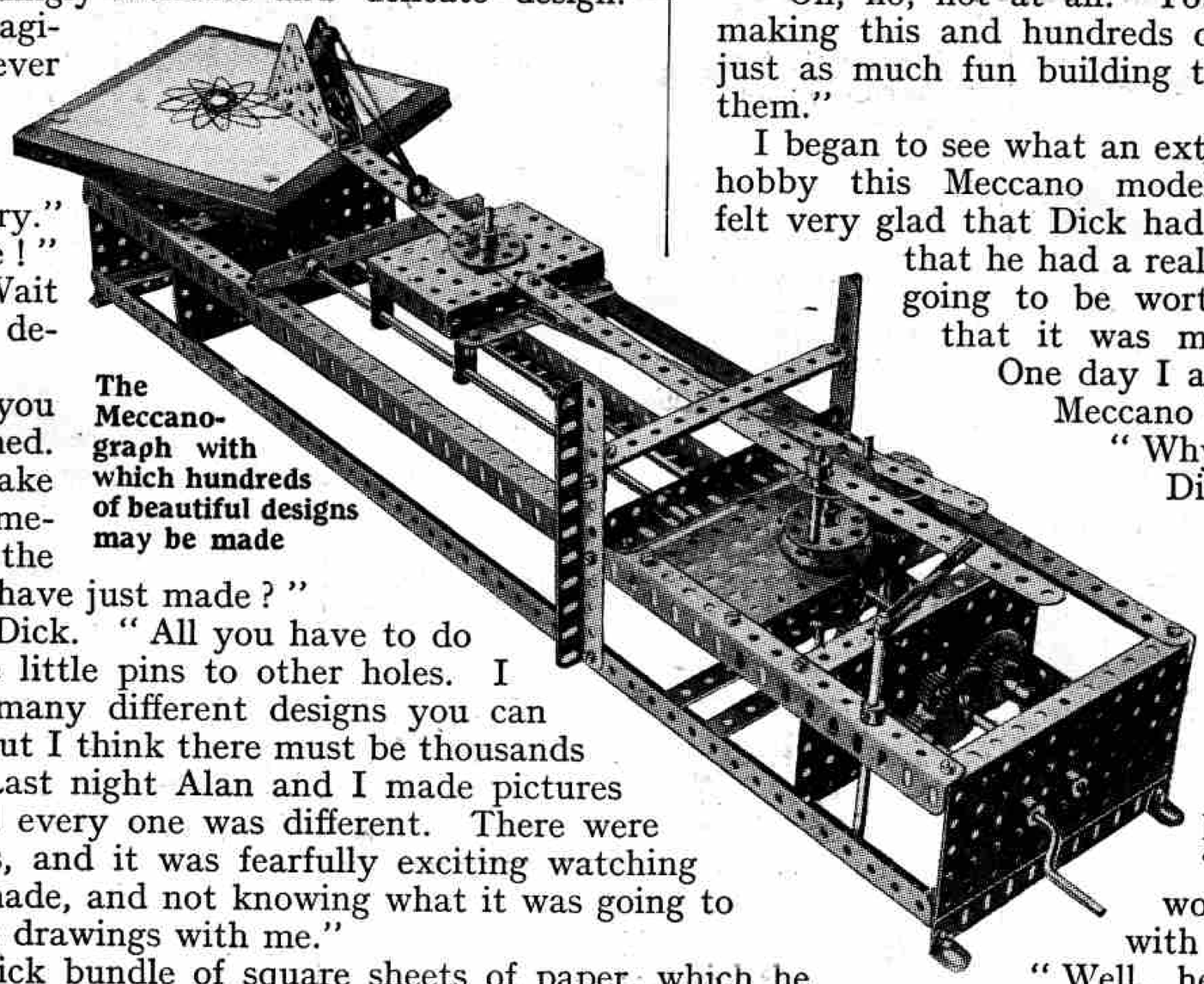
The Wonderful Meccanograph

He turned the crank, and the pen immediately began to trace an exceedingly intricate and delicate design. It was the most magical thing I had ever seen.

"How do you work it, Dick?" I asked. "Let me try."

"Wait a minute!" answered Dick. "Wait till I change the design."

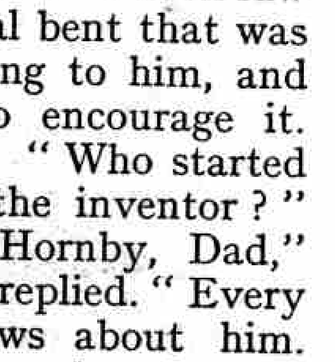
"What do you mean?" I exclaimed. "Can you really make the pen draw something else besides the lovely design you have just made?"



The Meccanograph with which hundreds of beautiful designs may be made

"Yes," replied Dick. "All you have to do is to change these little pins to other holes. I don't know how many different designs you can make altogether, but I think there must be thousands and thousands. Last night Alan and I made pictures for two hours and every one was different. There were some real beauties, and it was fearfully exciting watching the design being made, and not knowing what it was going to be. I brought the drawings with me."

He opened a thick bundle of square sheets of paper, which he handed over to me. On each was a different kind of Meccanograph design. In some the boys had used coloured inks, and had filled in parts of the design with water colours, giving a most fascinating effect. I gave up all thoughts of reading my paper, and spent the evening turning the crank and watching the pen go through its magical performance. I forgot all about going to the club, and Dick and I had the jolliest evening—the first of many such evenings we were destined to spend with Meccano.



"Where do you buy such a machine?" I asked Dick.

"You don't buy it at all," Dick replied. "You just buy a Meccano Outfit, and make it up for yourself.

"That's a drawback, isn't it?"

"Oh, no, not at all. You get full instructions for making this and hundreds of other models, and it is just as much fun building them as it is playing with them."

I began to see what an extraordinary and instructive hobby this Meccano model-building must be, and felt very glad that Dick had run across it. I soon saw that he had a real mechanical bent that was going to be worth something to him, and that it was my duty to encourage it. One day I asked him: "Who started Meccano? Who's the inventor?"

"Why, Frank Hornby, Dad," Dick quickly replied. "Every boy knows about him. He says he has a million boy friends!"

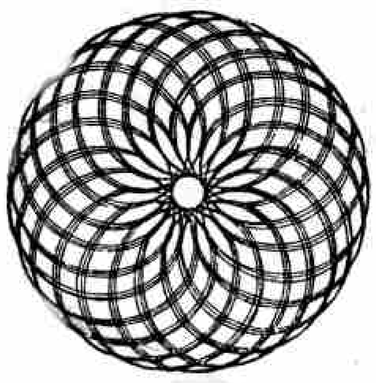
"I shouldn't wonder if he has," I said. "Suppose we look him up some day and cross-examine him?"

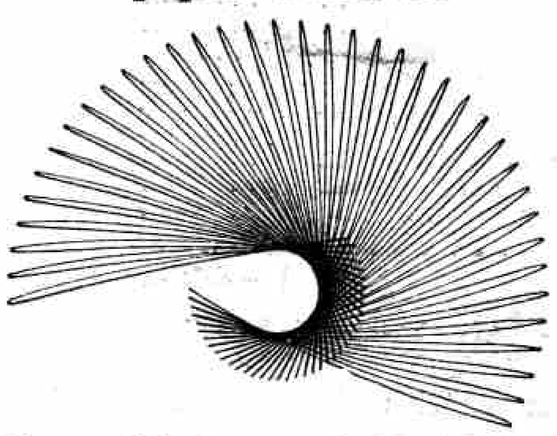
Dick's eyes glistened.

"Why! Do you think he would see us?" he said, with doubt in his voice.

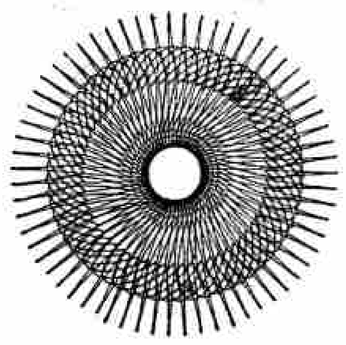
"Well, he's human like the rest of us, I suppose," I replied. "Anyhow, we will take a chance of his seeing us."

(To be continued)





We illustrate on this page five of the many beautiful designs that may be made by the Meccanograph. Hundreds of similar designs, each differing in pattern and detail, may be made with this wonderful model by a simple adjustment of the mechanism. Any design may be repeated at any time by reverting to a similar adjustment. In one of our future issues we shall give full details for constructing this splendid Meccano model.—EDITOR.



The Conquest of the Air—

(Continued from page 129)

the last lap, however, and when within about two miles of home, the big-end that had heated up when the oil pipe choked earlier in the week, gave way altogether and Piercey had to land.

Notwithstanding this hard luck, "*Wee Bee I*" remained the winner of the competition, with a total of 588.52 marks to its credit. How close Piercey came to an even greater achievement is clear from the statement that had the engine lasted only another one minute and forty-five seconds his figure would have been increased to something like 780 marks.

A High Tribute

The Lympne tests have proved that "*Wee Bee I*" is extraordinarily efficient aerodynamically, and in this respect Lieut. Col. W. A. Bristow, the aeronautical consulting engineer who kept the records of the competition, said: "no more efficient aeroplane than the Beardmore has ever left the earth."

The minimum thrust required at the propeller is only just over 5 h.p., so that the machine has a power-reserve of something like 17 h.p., a far greater percentage than is attained even in the most efficient modern commercial aeroplane. This extremely high power-reserve means that "*Wee Bee I*" has a good climb, and if necessary would be able to rise out of quite a small field. High power-reserve also means that the machine will not normally be flown at more than about one-half of the engine power, with consequent increase in reliability and greatly prolonged life of the engine. Machines less efficiently designed require nearly the whole of their available power for horizontal flight, and consequently their engines will not last nearly so long, nor will there be so much power in reserve for climbing.

It may also be mentioned that "*Wee Bee I*" possesses an excellent gliding angle (1 in 16.8), which enables the machine to glide to a suitable landing place, in case of engine stoppage. A less efficient machine would have to make a forced landing in the first available field.

Next month we shall give a detailed description of the construction of the "*Wee Bee I*" and also a special interview with the pilot, who will describe how the machine behaved during the Lympne tests.

Competition Corner

"What I should like to be, and why"

Essay Competition

Every week we receive letters from boys all over the world regarding their future careers. In many cases our readers are asking for advice as to the prospects of and methods of entering certain occupations, and in other cases they tell us which occupation they have chosen and their reasons for making this particular choice. We think it would be of interest to a large number of our readers to know which careers other readers are choosing, and their reasons for the choice. Therefore we have decided to announce this month an Essay Contest on the subject: "WHAT I SHOULD LIKE TO BE, AND WHY."

We hope to receive a large number of entries for this contest, and we feel sure that it will prove of interest to those boys who are nearing the end of their school days and are approaching the time when the choice of a career must be made. The winning essays will be published in the "*M.M.*"

The competition will be divided into two sections (A) for those of 16 years and over and (B) for those under 16. Four prizes will be awarded—Meccano goods to the value of £1/1/0 and 10/6 for the first and second in each section, respectively.

Essays must not exceed 1,000 words in length and must be written legibly and on one side of the paper only, with the competitor's name, address, and age *on the back of each sheet.* This contest will be decided entirely on the merits of the essays, and bad writers—provided, of course, that their writing can be read!—will not be penalised in any way as compared with good writers.

Closing date 30th April (Overseas: 31st July).

13th Photo Competition

Our Photographic Competitions continue to produce, month by month, a large number of entries of quite surprising quality, and a still more interesting fact is that the general level of excellence is undoubtedly higher now than it was a few months ago. We hope that the photographic page that will commence in next month's issue will encourage many more of our readers to take up this fascinating hobby and to enter regularly for our Photographic Contests.

Following our custom of choosing subjects that are within the reach of practically every reader, we announce this month as the subject of our Thirteenth Contest: "A TRAIN STANDING IN OR STARTING FROM A RAILWAY STATION." In this competition the size of the station and the nature of the locomotive and train will not be taken into consideration, so that a reader who has access only to a small country station will have an equal chance with a reader living near a large terminal station.

This contest will be divided into two sections (A) competitors under 14 years of age and (B) competitors of 14 years and over. Every entrant must write his name, address and age on the back of each photograph submitted, and must also state by whom the photograph was developed and printed. In the event of a tie for a prize, photographs that have been developed and printed by the competitor himself will receive preference. Envelopes containing entries should be marked "Photo Contest" in the top left-hand corner.

Four prizes are offered—Photographic goods to the value of 10/6 and 5/–, to be chosen by the winners, as first and second prizes respectively, in each section.

Closing date 30th April (Overseas: 31st July).

Competition Closing Dates:

Twelfth Photo	31st March.
Fourth Drawing	31st March.
Thirteenth Photo	30th April.
Essay	30th April.
OVERSEAS:	
"Sharp Eyes"	30th April.
Bargain Hunt	30th April.
Eleventh Photo	31st May.
Cycling Hints	31st May.
Second Drawing	30th April.
"My Favourite Railway" Essay	31st May.
Third Drawing Contest	31st May.
Twelfth Photo	30th June.
"Suggestions"	31st May.
Fourth Drawing	30th June.
Thirteenth Photo	31st July.
Essay	31st July.

Fourth Drawing Competition

The entries for our Third Drawing Competition have been very satisfactory as regards numbers, but less so as regards the quality of the drawings submitted. Apparently very few competitors have as good a knowledge of the details of an electric car as they have of a locomotive. We believe that Drawing Competitions of this character provide one of the best methods of developing quick and accurate observation, and therefore we are announcing this month our Fourth Drawing Competition, the subject of which is: "A PETROL MOTOR BUS OR MOTOR LORRY." Drawings may be made either in pencil or ink, but colours are not to be used.

The contest will be divided into class (A) for those of 16 years and over, and class (B) for those under 16. There will be four prizes. Drawing or painting materials (or Meccano products if preferred) to be selected by the winners, to the value of 10/6 and 5/– respectively for the first and second in each section.

Closing date 31st March (Overseas: 30th June).

Results

Cycling "Hints" Contest

As this was the first competition of its kind announced in the "*M.M.*" we naturally thought it would be popular, but we did not anticipate that the entries would be so numerous. Apparently our readers are still as keen as ever on cycling, and it is evident that they take great pride in their machines and that they are thoroughly up-to-date in their methods.

Four prizes were offered in this contest and the prize winners are as follows:—

FIRST PRIZE (pair of cycle tubes treated with "Fibermetic" puncture seal), W. Pearson, Aston, Birmingham. SECOND PRIZE (Veeder Cyclometer), W. Needham, Oldham. CONSOLATION PRIZES (Puncture sealing solution for two cycle tyres), H. Kelly, Droylsden, Manchester, and R. Woodcock, Wickersley, nr. Rotherham.

We hope to publish some of the winning hints in an early issue of the "*M.M.*"

Second Drawing Contest

The First Drawing Contest held at the beginning of last year was a great success, but this Second Contest has exceeded all expectations. Most of the entries received showed not only an excellent knowledge of locomotive construction but also real artistic ability. All entries were examined with the utmost care, and after a great deal of consideration we decided that the drawings submitted by R. W. Tippetts (Acocks Green, Birmingham), and F. Edgar (Blaydon-on-Tyne), were the best in Class A and were of equal merit. We therefore decided to award to each of these competitors a prize of Meccano Products to the value of £1/1/0. In Class B the first prize (Meccano Products to the value of £1/1/0) was won by P. Duxbury, of Margate, and the second prize (Meccano goods value 10/6) to E. Mitchell, of Chester.

"Sharp Eyes" Contest

This competition has been received with the greatest enthusiasm and entries from boys and girls of all ages have literally poured in from all over the United Kingdom. This big response entailed an enormous amount of work, as we make a point of carefully examining each individual entry. It was surprising what remarkably sharp eyes most of the competitors had—even a mistake in the smallest detail being readily detected, proving that the drawing must have been scrutinised with the greatest care. A large number of readers submitted entries showing well over one hundred errors, but in every case the total was reduced by the judges owing to mistakes being shown that were not really genuine errors. Some competitors went so far as to try and penetrate the picture and see the mistakes on the other side!

After carefully going through every mistake found in each entry and in accordance with the rules governing this contest, the prizes have been awarded as follows:—

FIRST PRIZE (Hornby No. 2 Goods Set), W. Mitchell, Exeter, Devon.

SECOND PRIZE (Hornby No. 1 Goods Set), C. F. Floyd, Knowle, Bristol.

THIRD PRIZE (Meccano No. 1 Radio Receiver or Double Headphones), E. Jones, Park Row, Nottingham.

Cross Word Contest

During the month of January entries for this competition were showered upon us in sack-loads until it became quite a problem to know where to store them! It has been a most difficult proposition sorting out these Puzzles and judging the winners. Most of the competitors solved our puzzle correctly, but the most important part with which we had to deal was the puzzles invented by the competitors themselves. Some of these were certainly very ingenious and the dictionaries must have been subjected to some very hard work!

Three prizes were offered in this contest, and finally these were awarded as follows:—

FIRST PRIZE (Meccano Goods value £2/2/0), G. S. Marsh, Blackpool.

SECOND PRIZE (Meccano Goods value £1/1/0), V. R. Neville, Blackpool.

THIRD PRIZE (Meccano Goods value 10/6), E. A. Horne, Muswell Hill, London.

In addition a consolation prize of a Meccano Writing Pad has been awarded to A. Russell, of Abbeyhill, Edinburgh.

OUR MAIL BAG

In this column the Editor replies to letters from his readers, from whom he is always pleased to hear. He receives hundreds of letters each day, but only those that deal with matters of general interest can be dealt with here.

Correspondents will help the Editor if they will write neatly in ink and on one side of the paper only.

S. A. S. Rogan (Madras).—We are pleased to learn that you have been so successful in your examinations, and that you now intend to continue your studies in this country. If you will write to the Secretaries of either of the colleges you mention they will give you full information. Thanks for the puzzles, which we hope to use.

S. P. Langridge (Oporto).—We are always glad to hear from British boys who live abroad, and we have read your account of conditions in Oporto with great interest. We send more and more Meccano to Portugal each year, and soon you should experience no difficulty in obtaining all accessory parts locally. We are pleased that you enjoy the "*M.M.*" so much.

C. C. McCallum (Anchineruine).—Your article on the Meccanograph will receive consideration later, but at the present time there is so much that we *must* put in the "*M.M.*" and really so little space available in spite of the increased number of pages. The new Hornby electric trains are in preparation, and the Meccano factory is well ahead with the work. We shall be able to make an interesting announcement on this subject very shortly.

J. A. Saddler (Adelaide).—We are gratified that you and so many other overseas readers take such an interest in our railway articles. These will be continued and will, we hope, form a permanent feature of the "*M.M.*" Any Meccano user can tell the year when his Manual was published, by referring to the number at the left hand bottom corner of the cover. If the number is 23 it indicates that the Manual was printed in 1923, 24 denotes 1924, and so on.

L. Stanley (Kingsbridge).—It will evidently be necessary for you to wait a little longer for your No. 2 Tank Loco, but it will come later, never fear, if you wish hard enough! Thanks for your good wishes and congratulations.

E. Breton (Chiswick).—Most parents are only too glad to encourage their boys to play with Meccano, and we rarely come across an instance where its use is discouraged. One very highly-placed man in this country told us recently that he always gave his boys a big Meccano Outfit when they were young, as he considered that the Meccano training would be worth £10,000 to them when they grew up.

W. H. Hope (Ellesmere Port).—"The members of our Meccano Club consider the "*M.M.*" to be one of the seven wonders of the world, and we wonder when it is going to stop growing." It may stop growing in size some day, but it will never cease to grow better in quality, W.H. We are sorry to hear of the damage to your wrist, and we hope you are quite alright again now.

R. Shaw (Calcutta).—We shall be very glad indeed to receive a photograph of yourself standing by your best Meccano model, and we may be able to publish it if suitable.

F. D. Cowley (Hale).—We have received many hundreds of congratulations on the recent improvements to the "*M.M.*" but none more cordially worded or more acceptable than your own. The number of literary pages has now been permanently increased.

J. A. Dean (Stretford).—Many thanks for your letter and permission to make use of same, of which we hope to avail ourselves. Your son is bright beyond the average, and we are interested in his doings and sayings. He is fortunate in having a father to encourage him in his natural bent!

K. Russ (Dongarra, W.A.)—Thanks for your interesting local news. No doubt Geraldton will be a leading port in due time. Major Brearly is evidently a progressive man and is anxious to place your air service on a sound footing. Your hay wagon, drawn by five horses, is on a bigger scale than anything we have seen in this country.

L. Trenberth (Redruth).—We congratulate you on the progress of your Club. It shows considerable enterprise on the part of all your officials and members that you have been able to establish a Library and a Museum, and run a Savings Club.

F. B. Treath (Young, N.S.W.)—We were sorry to hear about your cold, but no doubt you are alright again now, and riding around the country on your pony. Your snapshot is not a good one, and we should like to see something better.

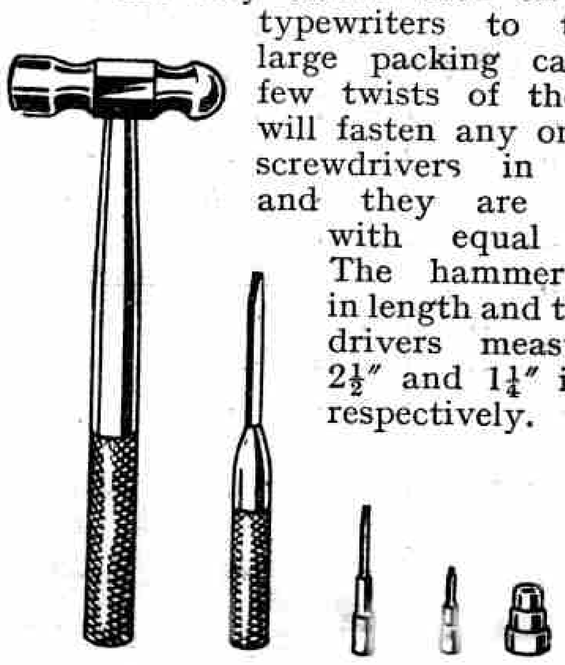
OUR BUSY INVENTORS

RECENT INTERESTING PATENTS

Every day new inventions and ingenious labour-saving devices are being brought into existence, and from time to time the most interesting of these inventions are described and illustrated in these columns. Readers are invited to send particulars (accompanied, if possible, with photographs or rough sketches) of any interesting inventions or devices that may come to their notice. Payment at our usual rates will be made for any contributions used.

Three Tools in One

A hammer with three screwdrivers in its handle is the invention of an American engineer. The screwdrivers are made of specially strengthened steel and will fit any size of screw ordinarily encountered, from the tiny screws used on portable typewriters to those in large packing cases. A few twists of the handle will fasten any one of the screwdrivers in the bit and they are detached with equal facility. The hammer is $7\frac{1}{2}''$ in length and the screwdrivers measure $5\frac{1}{2}''$, $2\frac{1}{2}''$ and $1\frac{1}{4}''$ in length respectively.



Two Pianos in One

Those of us who have listened to the broadcast of the Savoy Orpheans from the London station have often admired the piano effects, especially when we have been favoured with a pianoforte solo. The explanation of the increased musical tone and possibilities is afforded by the fact that the piano used has a double keyboard. It is claimed to be the only piano of its type in existence, although other pianos on the same lines are now being manufactured for American dance orchestras. The double-keyboard piano is particularly serviceable for jazz orchestras where an ordinary piano is not sufficiently powerful. The piano used by the Savoy Orchestra may be played as an ordinary piano when desired, but the movement of a lever converts it into a double piano, by which any note struck also strikes a corresponding note an octave higher.

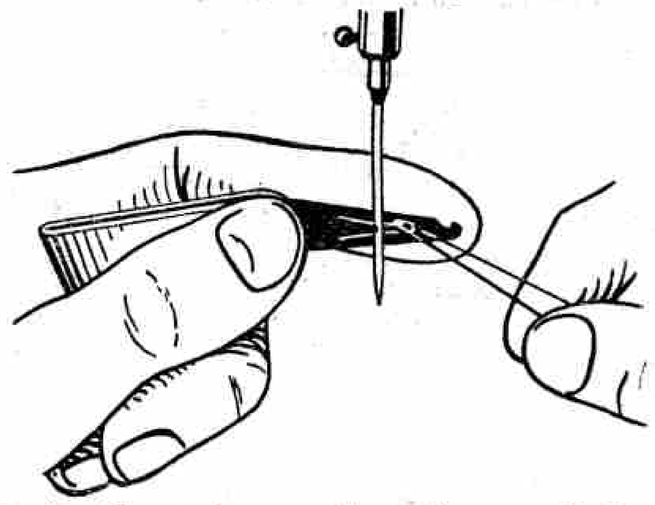
Piano with Short Keys

Another form of piano with a double keyboard has recently been invented by Dr. Moritz Stoehr, of New York, inventor of the Musical Typewriter, a device for transposing and recording music. Dr. Stoehr could see no reason why the keys of the piano should be as long as they are in the standard type. He noticed, too, that musicians do not strike the keys near the edge, but most of them use only a small part of the key near the black notes. In his piano, therefore, he has reduced the size of the keys and this has enabled him to introduce a second keyboard in the form of a step, the second keyboard being a step higher than the first. This allows of two pianos being embodied in the one frame, but those who have seen the inside of a piano will understand that there has been some considerable difficulty in arranging the notes and wires of the second piano without disturbing those of the first.

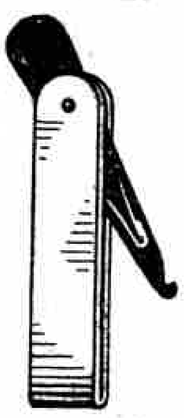
We know that with Meccano any mechanical movement is possible, but we hope our readers will not be tempted to endeavour to emulate the inventor by experimenting on the family piano!

For Bachelors Only

Having doubtless wasted many hours vainly trying to persuade a piece of cotton



to go through an absurdly small hole, an inventor has recently patented a needle-threader. The device has two thin steel blades with hook-like points, the larger one being for use with darning or sewing-machine needles. In operation the blade is inserted in the eye of the needle to be threaded and the thread is passed over the hook and pulled through the eye of the needle as the point is withdrawn. Needles of various sizes may be threaded quickly with the device, which should certainly prove a great boon to bachelors, although it will probably not be allowed in "threading-the-needle" races at your school sports!



A Miniature Calendar

A perpetual calendar that fits into the back of a watch has been invented to help people to remember the date and day of the week. It may also be worn as a watch-charm or trinket, and consists of three discs, showing the month, day and date. These discs are mounted on a spindle behind the main disc, in which there is an opening to show the particulars for the day, the disc being revolved by spur-gears.

Stamps for Sale

(*See also page* 136).

Gratis—10 Togoland
Also "Gem" Stamp Wallet

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All absolutely free to Stamp Collectors sending **6d.** for cost of our **ILLUSTRATED CATALOGUE AND GUIDE, 1925,** inc., splendidly illustrated Catalogue of 18,000 varieties in Single Stamps and Sets, **GIVING THE LATEST CATALOGUE VALUES.**

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Free Gift Packet. 75 Different

including stamps from Argentine, Brazil, Chili, Haute Volta, Oceania, Persia, Cameroons, Tunis, Siam, Guadeloupe, Runion, Martinique, Morocco, Niger Coast, Senegal. Also sets of 15 Belgium, 10 Holland, Air Post Stamps, British Colonials, etc. **Absolutely Free** to all Collectors asking to see my bargain Approval Books.

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The "1925" Bargain Packet 1/- Post Extra.

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Sets of **Australia, Canada, India, New Zealand, Africa,** etc. All obsolete many years ago, and a collection of value in itself. Also mint set of 6 Ukraine Republic (Pictorial). Set of 5 **French Colonies, Danzig, Aeroplane, Nyassa**; 50 grand stamps in all—a real New Year's bargain. Ask to see our Victory Approval Sheets, the last word in quality and cheapness. Application from Collectors in the Colonies particularly requested. Sole Address: **The British & Colonial Stamp Co., 57, Winchester Road, Twickenham, Middlesex.**

A Unique 100 Stamps FREE,

including used and unused, all different. To applicants for my famous approval sheets of ½d. stamps. Enclose 1½d. postage.

FLEMING,
St. Winifreds, Christleton Rd., Chester.

FREE! FREE!

Egyptian War-Censored Envelope and 25 diff. Portuguese Colonials will be given entirely FREE to serious collectors asking to see my approval selections of stamps, which cannot be excelled for condition and price. 6d. in the shilling discount is allowed on **all** purchases, whether large or small. Enclose postage and mention Gift M.M. 4.

N. R. ENSOR, 2, Oak Road, BOURNEMOUTH.

FREE! and POST FREE!

The **Mint** Packet containing **75** different Stamps including a magnificent set of **25** unused **Portuguese Colonials** from **Acores, Guinea, Mozambique, Cape Verde, St. Thomas and Prince** and **Angola,** mint set **Poland, Danzig, Schleswig, Scarce Ukraine** and a host of other good stamps nearly all unused.

In order to circulate our Price List and old Pre-War Approval Sheets from which we are clearing stamps at half price we will send the **Mint Packet Free** and **Post Free** to all applicants (abroad 2½d).

SPECIAL OFFER.—Complete mint set of 39 diff. scarce 1923 **German Provisionals** from 5,000 m. on 40 m. to 1,000,000,000 m. on 100 m. (usual price 2/–) offered for **6d.** post free. Collections and Loose Stamps bought. Highest prices paid.

HORACE MILLER & CO., WHITSTABLE.

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A splendid advertising offer containing: 62 all different stamps from Algeria, scarce old Holland, Duchy of Luxembourg, Ukraine Republic, Cuba, rare old G.B. German occupation of Belgium, 40 scarce all different unused interesting Scandinavia, pictorial Air-post Stamp, British Colonials, etc. Also a most useful pair of Nickel Tweezers, a fine tabulated list (Abyssinia-Victoria) of Countries, ready gummed, and a packet of finest Stamp Mounts. Request approvals and send Postcard only.

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1,000 500 well-mixed Foreign Stamps containing many usually sold at ½d. and 1d. each. 100 UNUSED (a complete sheet), 25 well-mixed BRITISH COLONIALS, a 12-page booklet for holding duplicates and 375 Patent "Strip" Stamp Mounts.

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25 English Cols.	3d.	5 Venezuela ...	3d.
50 ,,	6d.	10 ,, ...	7d.
75 ,,	9d.	15 ,, ...	1/–
100 ,,	1/–	20 ,, ...	1/6
25 Portuguese	4d.	25 Holland ...	6d.
50 Cols.	9d.	50 ,, ...	1/–
75 ,,	1/–	25 Belgium ...	6d.
100 ,,	1/3	50 ,, ...	1/–
25 French Cols.	4d.	25 Bavaria ...	4d.
50 ,,	9d.	50 ,, ...	9d.
60 ,,	1/3	25 Roumania ...	6d.
25 France ...	3d.	50 ,, ...	1/–
50 ,, ...	6d.	25 Italy ...	6d.
75 ,, ...	1/–	50 ,, ...	1/–
25 United	3d.	25 Swiss ...	6d.
50 States	6d.	50 ,, ...	1/–
75 ,,	9d.	25 Portugal ...	9d.
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Fine selections ready in separate countries.

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MANY RARE STAMPS have been found by purchasers of THE "DIAMOND" PACKET, which is guaranteed to contain 1,000 Unsorted Stamps 1/3 (from Convents abroad). 2 packets, 2/5; 3 packets, 3/6; 4 packets, 4/6; 5 packets, 5/6. All post free. (Abroad 3d. per packet).

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Postage extra (1½d.)

C. Faulkner,
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MINT BRITISH EMPIRE

Fill those Blank Spaces in your Album with good stamps. Quality not quantity counts. My new Price List of Modern Mint Colonials is now ready, containing dates of issue, watermarks, colours, and all particulars, and will be sent to any collector interested on receipt of 1½d. stamp to cover postage.

ALEC KRISTICH (N.R.P. 279),
82, Marchmont St., Russell Sq., London, W.C.1.

"LORD BYRON" PACKE 6D.

30 Sound Colonial and Foreign Stamps, cat. over 6/–, including 2 drachma Byron 1 and 2 Esc. Portugal, U.S., Africa, ½ to 1/–, Palestine, Holland Jubilee various Air Posts, France Pasteur. Postage extra.

J. H. Gaze, Didsbury, Manchester.

15/– WORTH CHOICE STAMPS FOR 3d.

Packet No. M.B. contains rare **Jamaica 2/-** Chocolate Q.V., 1/- brown Q.V., 6d. orange Q.V. Set 5 **Deccan Hyderabad** Indian Native State. U.S.A. 1/- orange. Set **6 Canada** pr. **Ukraine** on **Russia Rbl. Egypt** 20m., & 40 other used and unused stamps. The lot 3d. Postage 1½d.

15/- 3D.

Nelson T. Hillier, The Stamp Mart, Horsmonden.

TWO △ NYASSA

Pictorial Malta, Palestine, Nigeria, Egypt (King Fuad), Gold Coast, 5 Germany on rose paper, 8 Germany, posthorn type, 3 Germany, airpost, making up 100 nice all different.

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containing **50** Selected Varieties, including **Thurn and Taxis, Cayman Is.,** Persia, **Montenegro, Kedah,** Jugo-Slavia, **Libya,** Venezuela, **Oubangui, Soruth,** etc., etc. Send 2d. for post and packing, and ask to see my **Bargain Approvals,** and above Packet will be sent **Free.**

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25 ALL DIFFERENT BRITISH COLONIALS FREE

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25% Discount on purchases of 2/6 or over.

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THE MIDLAND STAMP CO. LTD., 78, Warwick Street, Leamington Spa.

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50 British Colonials (Cat. over 5/–
5 Air Post ... ...

1/- Post Free.

Send for my ½d. and ½d. approvals.
Wonderful Value.
Better class for medium collectors.

W. H. TAYLOR,
26, Meadows Road, Sale, Cheshire.

40 BRITISH COLONIALS FREE

This Free Gift will be sent to everyone asking to see a selection of stamps on approval. British Colonials only will be sent to those who prefer these.

POST FREE.

E. T. COX, 13, Britannia Rd., Parkstone, Dorset.

BIG PARCEL FREE

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Unused Colonial and Foreign, catalogued **10/–.**
50 all different clean stamps, many unused.
100 Perfect Peel-Off Stamp Mounts.
Invisible Pochette for preserving rare stamps.
Strong Board Perforation Gauge.
Vest Pocket Folder for holding duplicates.
Particulars of our Free **20/–** Collections.
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Latest Copy of Stamp Bargains.

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. . . ASK FOR . . . RECORD PARCEL

He who hesitates may be too late. Only 1 lot allowed each applicant.

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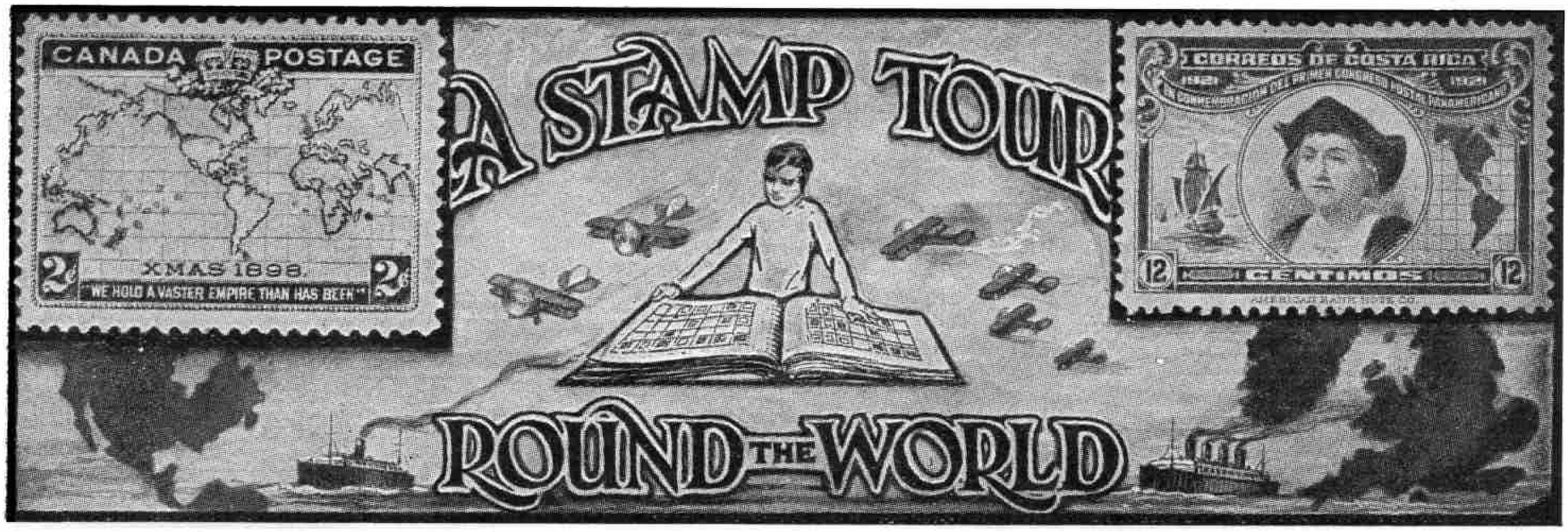


VII. THE ISLANDS OF THE PACIFIC.

WE conclude our aeroplane tour of the South American continent by flying across the Andes to Santiago, the capital of the republic of Chile. Santiago was founded in 1541, and is situated about 1,860 ft. above sea-level on a wide and beautiful plain between the main Andes and the Cuesta del Prado mountains.

To commemorate the holding of the Fifth Pan-American Congress held in this city in 1923, a set of stamps consisting of eight values was issued on 28th April of that year. The one type, which we illustrate, was used for all values and shows a view of the Palace of Santiago with its beautiful grounds. The stamps were printed by two operations, the view being executed by the line-engraved process and the values and borders by lithography. One million copies of the 2c. and 10c. were printed, half a million of the 4c., 20c., 40c., and 1 peso, and one quarter of a million of the 2p., and 5 pesos.

Santiago is about 115 miles east of Valparaiso, to which port we now fly. Here we find our liner, which has sailed down the western coast of the continent and is waiting to take us on board for our tour of the Pacific.

The Cook Islands

Our first call is made at Rarotonga, the chief island of the archipelago known by the general name of Cook Islands. Since 10th June 1901, the islands have been under the control of the governor of New Zealand, although they still issue their own distinctive stamps.

In August 1920 a pictorial series was issued, two values being illustrated here. The same designs were used for two sets, one bearing the name of Rarotonga, the other Aitutaki, which is the name of another island in the group.

The ½d. value shows Captain Cook landing on the islands when he discovered them in 1777. The view shows a portion of the coast with mountains in the distance and palms in the foreground. In the bay is the explorer's ship, and the captain himself is just about to jump ashore from the small boat that has brought him. Several savages, who were at that time man-hunters and cannibals, are seen excitedly awaiting the explorer's approach.

The 1d. shows the wharf at Aitutaki, the 1½d. a handsome portrait of Captain Cook. The 3d. shows a palm tree, probably to remind us that Aitutaki has most luxuriant coco-nut palm groves. The 6d. (illustrated) shows a view of some native huts, with their inhabitants and pets, on the island of Mitiero. The 1/–, the highest value, also illustrated here, shows Avarnua harbour, with its jetty and huts and with the volcanic cones rising in the interior of the islands.

Nauru, our next port, is a small island of the Marshall Group situated very near the Equator. The shores of Ocean Island, one of the group, were shown in the pictorial series of Nauru issued in 1924 and illustrated and described in our January, 1925 issue. The soil of Nauru and Ocean Island is largely composed of phosphate of lime, and owing to the great value of this substance as a plant food, the islands are in themselves probably the richest in the world.

Honolulu, the Stopping Station of the Pacific

We now turn due North-east and sail in that direction for about two thousand miles until we arrive at Honolulu, the capital of the Hawaiian group, a colony of the United States of America. A view of Honolulu is illustrated here, the stamp being one of a series designed by E. W. Holdsworth, of Honolulu, engraved and printed by the American Bank Note Co., New York, and issued between the years 1894 and 1899.

These islands also were discovered by Captain Cook in 1778, the year after he had discovered the Cook Islands. Although he was received with great delight by the natives, who looked upon him as a kind of god, he was killed on the beach of Kealakekua Bay in Hawaii the following year by a native. In spite of this apparent ill-feeling against him, his death occasioned very great distress and, until the natives were converted to Christianity, his tomb was made a place of pilgrimage and the priests received offerings on his behalf.

The Hawaiian islands are very mountainous and here is found Kilauea, the largest active volcano in the world. It was last in eruption in 1922 when great streams of molten lava flowed over the surrounding countryside.

From Honolulu we turn westwards again and begin our long voyage across the second half of the Pacific to Japan. This portion of the Pacific is further north than that containing all the immense groups of islands and so for nearly four thousand miles we journey on without a glimpse of land.

The Beautiful Mountains of Japan

Our goal in Japan consists of a visit to Mount Fuji-yama, the finest of all Japanese mountains. We leave our ship at Yokohama and take the train to Gotemba at the base of the mountain and spend the next day or two in making the easy climb to the summit.

The highest point is 12,395 ft. above sea-level and consists of a huge crater, for Fuji is, of course, a volcano. Although it is now believed to be almost extinct one can never be sure of a mountain in Japan, for the quietest volcano is always liable to burst into a fury of smoke and lava. It is largely due to the great streams of lava that have flowed from the crater of Fuji in past times that it is shaped in such a remarkably graceful curve. This is excellently shown in the Japanese stamps issued in 1922 bearing a view of this mountain.

The series consisted of three values, 4, 8 and 20 sen, and was printed by the Government Printing Bureau, Tokio, on granite paper. The watermark is a series of wavy lines and the perforation 13 by 13½ between the stamps.

From Japan we sail southwards to Formosa to visit Mount Morrison, pictured on the two commemorative stamps issued by Japan in April 1923, to celebrate the first visit of the Imperial family to Formosa. Fuji-yama was Japan's highest mountain

until Formosa was added to her dominions. Mt. Morrison (14,270 ft.) and Mt. Sylvia (12,480 ft.) then took the first and second places, Fuji being the third highest.

Mount Morrison is rather more than half way down the east coast of the island and stands nearly on the Tropic of Cancer. The mountain is one of the few found in Japan that are not volcanic. It is surrounded by many other large mountains and is therefore not a very conspicuous object.

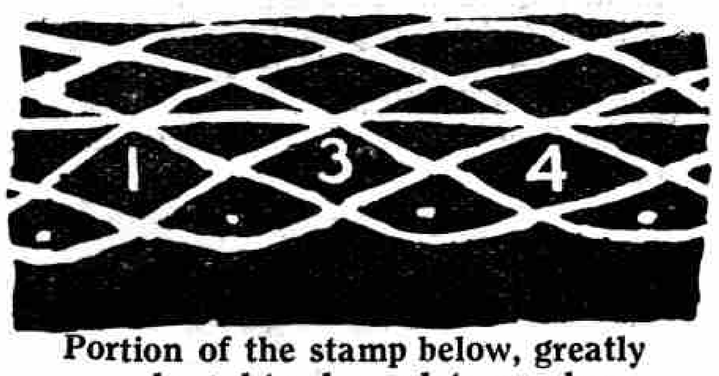
NEXT MONTH:—

The East Indies and New Zealand.

How to find Plate Numbers

"Plate numbers" appear to be a mystery to many young collectors. Perhaps this is because now-a-days plate numbers usually appear on the margin of each sheet of stamps instead of on the stamp itself, and after all, not many people are lucky enough to obtain at the Post Office a stamp with a margin in which the plate number appears. Even fewer people buy a whole sheet of stamps at a time, so plate numbers are not often seen or enquired about, except by those collectors who specialise in them.

Between 1858 and 1880 plate numbers appeared on every British stamp, as well as on the sheet margins, with the one exception of the 1d. red with letters in the bottom corners only, which stamps had no plate numbers. Our present English stamps have no plate numbers, but instead have control letters and numbers in the margin of each sheet.



Portion of the stamp below, greatly enlarged to show plate number

On British and British Colonial stamps, the plate number shows the order in which the printing plates for those particular stamps were made. Sometimes only one batch of impressions would be taken from a plate, but at others two or even three printings would be made before a new plate was considered necessary.

Plate numbers appearing on the stamps themselves are peculiar to the stamps of Great Britain. The 1d. reds of Queen Victoria's reign are the most famous of these numbered stamps. In their case the numbers are found in the vertical columns of net-work at each side of the Queen's head.

The numbers may be seen with the naked eye, and a sharp-eyed person will generally be able to read them. In some cases, however—and more especially in those where the cancellation mark on the stamp comes over or near the number—a magnifying glass will be found necessary to identify the number. Our two illustrations will show exactly how these plate numbers are placed.

The numbers run from 71 to 225, but 75, 126, and 128 are non-existent. Plate number 77 is by far the rarest, only seven or eight copies being known. There is one in the Tapling collection in the British Museum, but there must have been several issued, for at least one sheet of 240 stamps would be printed. Any stamp collector has the chance of being the lucky finder of a Plate 77, and such a discovery would benefit the finder to the extent of some hundreds of pounds! Now, you "Sharp-Eyed" Meccano boys, get busy.

Collecting plate numbers is one of the interesting sides of stamp collecting, and it is exciting work searching for special numbers to fill the blanks. The 1d. reds are fairly common, and as they may be purchased at about 1/- per 100 it is not a very expensive matter to complete a set with the exception of one or two rarities.

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THE CABLE ACCESSORIES CO. LTD., TIPTON, STAFFS.
London Depot - - 28, SHOE LANE, E.C.4.

STAMPS FOR SALE

(*See also page* 134)

COMPLETE SHEET, and 112 different stamps, 6d.—Kraus, 137, Cheapside, London, E.C.2.

100 DIFFERENT STAMPS FREE. Send for ½d. approvals.—Cox, 135, Cambridge Road, Seven Kings.

BRITISH COLONIALS ON APPROVAL, one third Gibbons, good copies.—Barlow, 18, Wish Road, Hove.

Foreign Stamps On Approval, all ½d. each, suit beginners.—J. Gleave, Market Hall, Inverness.

1,000 Mixed Stamps, 9d.; 50 different Portuguese Cols., 6d.—Hulse, Silverdale Rd., Wolstanton, Staffs.

GENUINE BARGAINS IN STAMPS. Surprise gift with approvals.—Butler, 46, Antill Road, Bow, E.3.

FREE PACKET (value 2/6) to all genuine applicants for approvals, farthing upwards. Splendid value.—Claypoole, 33, Kingsley Avenue, Kettering.

STAMPS. Selection of Cheap Approvals, Foreign and Colonial at a ¼d. each, used and unused.—A. F. Langton, 37, Allison Road, Harringay, London, N.8.

CHEAP APPROVALS. Suit beginners, ¼d. and ½d. each.—J. H. Douglas, Brenanstown, Cabinteely, Co. Dublin.

500 UNSORTED AND SET PERSIA FREE, 2d. postage, request approvals.—Adams, 39, Scotts Rd., Leyton.

1,000 MIXED STAMPS, 7d.; Superior, 1/-; "Bumper," 2/6; Albums from 1/-, postage extra.—Cranwell, 55, Cowslip Road, London, E.18.

1,000 BRITISH COLONIALS including Dollar, Rupee and Shilling Values, 3/- post free.—H. Theobald, 54, Antill Road, London, N.15.

FREE. 50 Stamps to applicants enclosing postage and asking to see my cheap approvals.—Scott, 154, Wellesley Road, Ilford.

11 TRAVANCORE AND LARGE PRICE LIST FREE to approval applicants enclosing 1½d.—S. Huckle, 53, Birkenhead Avenue, Kingston-on-Thames.

SPACE FILLERS, ¼d. to 3d. About 500 sent on approval. A useful selection.—D. Pratt, 10, Lion Gate Gardens, Richmond, Surrey.

Six Revolutionary Crete Free to "Big Discount" approval applicants.—H. Scott Johnson, C.P.A., Room C, 49, Felden St., S.W.6.

BREAKING LARGE COLLECTION. I have some really good stamps for disposal. Send for approval Sheets, 66⅔% off Gibbons' Catalogue.—Williams, 16, Clayton Road, Hayes, Middlesex.

SELLING-OFF BARGAINS. 200 Stamps, many unused, 1/6 Postal Order. FREE GIFT to first twenty applicants.—Dickinson, Dept. M.M., 733, High Road, Leyton.

FREE. 25 PORTUGUESE COLONIALS AND 25 AUSTRIA to approval applicants. First five also receive set 14 "Volkstaat Wurttemburg." Ask to see selection of your favourite country.—**F. C. Kearley, 142, Purves Road, Kensal Rise, London.**

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MINT BRITISH COLONIALS. Ascension, Levant, Solomon, Cayman, Cyprus, Fiji, Turks, Iraq, Mosul, Malta, 5d. post free. Two Falkland Isles War Mint included if approvals desired. Foreign and Colonia Bargain Lot, about 250 stamps, post free 7½d.—Morris & Co., Stamp Dealers, Bletchley.

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Readers frequently write to me asking if I can recommend books that are both of interest and of use. In this column I hope to review books that I consider specially appeal to Meccano boys. I do not actually supply these books, which may be obtained either through any bookseller or direct from the publishers.—EDITOR.

Practical Electrician's Pocket Book, 1925
by H. T. Crewe
(Rentell, 3/– net).

The 27th annual issue of this welcome work of reference comes to us with the assurance that it has been most carefully revised and that many sections have been re-written. These include the chapters on Measuring Instruments, Railway Signalling Apparatus, Wiring Systems, and Wireless. There is also a new chapter on the Time Switches that are now being installed in increasing numbers all over the country. Other alterations have been made here and there where necessary to maintain the reputation for accuracy that this pocket book has held for many years. We are pleased to note that the Metropolitan Electricity Undertakings are now arranged in alphabetical order—a decided improvement. We have no doubt this new edition will meet with the cordial appreciation that it fully merits.

"The Book of the Wireless Valve"
(The Mullard Radio Valve Co. Ltd., price 1/6).

A particularly interesting little book on the wireless valve comes from the Mullard Radio Valve Co. Ltd. Commencing with a brief history of the invention of the valve the book passes on to explain in simple language exactly what the valve does, and wherein lies its great value for wireless. Later chapters deal with valves for all kinds of purposes, either reception or transmission, and point out the particular features that make each type valuable for its own particular work. Some interesting details of the low temperature valves are also included. In short, this little book covers practically every feature of the modern wireless valve, and its value is greatly enhanced by a large number of clearly-drawn diagrams and some interesting photographs showing various stages in the manufacture of valves.

"Photography and its Mysteries," and "Electrical Amusements and Experiments."
By Charles R. Gibson, F.R.S.E.

(Seeley Service & Co. Ltd., London. 5/– net each).

Mr. C. R. Gibson's activities as a writer on popular science show no signs of slackening, and in his two latest books, "Photography and its Mysteries" and "Electrical Amusements and Experiments," he fully maintains his standard of accuracy and interest. In the first-named volume the history of photography is briefly traced and its mechanism explained, and the remainder of the book is devoted to some of the more remarkable uses to which photography has been applied. We are shown how it aids the police, and how it is used for making pictures through the microscope and the telescope

In "Electrical Amusements and Experiments" Mr. Gibson leaves the beaten track and shows how electricity can be utilised for an almost endless number of interesting and amusing experiments and illusions, and how by its aid we may accomplish remarkable conjuring tricks that will surprise and mystify our friends. The various sections of the book are well illustrated by diagrams and photographs.

"The Schoolboy's Annual."
(B.O.P. Office. Price 3/6 net).

It would be difficult to find a better collection of sea yarns for boys than those gathered together this year in the "Schoolboy's Annual." There is the real sea flavour about these tales, and once a boy has started to read this Annual it will be difficult to tear him away from it. The illustrations are numerous and good, and the volume is an ideal gift for any boy who loves the sea.

"*M.M.*" Back Numbers

In the advertisement columns of the "*M.M.*" a reader recently offered 2/6 per copy for certain early numbers of the "*M.M.*" in order to complete his file. This offer indicates the value placed upon the "*M.M.*" by Meccano boys, and we suggest that you should see that your file of copies is complete. Have your Magazines bound by some local firm who specialises in binding, or keep the Magazines in the special spring-back binder illustrated here. This binder has a strong stiff back, holds a large number of copies, and keeps them neat and clean. Covered in black imitation leather, tastefully tooled, lettered gold, its price is 3/– (post free) from this office.

MECCANO LTD.
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The Meccano Idea—(*cont. from page* 115)

All the necessary pipes for water, gas or electricity are sent from the works with the plates, and during erection are simply joined by screwed unions. The house is provided with a complete hot water system, supplied from the kitchen range, or if there happens to be no fire in the range, hot water is supplied to the sink and bathroom by a copper, heated by a gas ring.

These ALL-steel houses will not be monotonous in appearance, as all the units are interchangeable and may be arranged to suit any design within the limits of the 3 ft. 6 in. space.

The Meccano house is a fitting name for such a well-designed structure, and its invention should go far towards helping to solve the acute housing problem.

The Tragedy of the Matterhorn

An Adventure in the Alps

The Matterhorn, or Mont Cervin as it is sometimes called, is an Alpine peak 14,781 ft. in height, and situated a little to the south-west of Zermatt. Although considered unconquerable, this peak was ascended by a band of intrepid climbers on 14th July, 1865, with the tragic results detailed in this article. It is interesting to know that by means of ropes, chains, and ladders, the ascent of the Matterhorn is now comparatively easy from either side, while huts at short distances provide shelter in case of need.

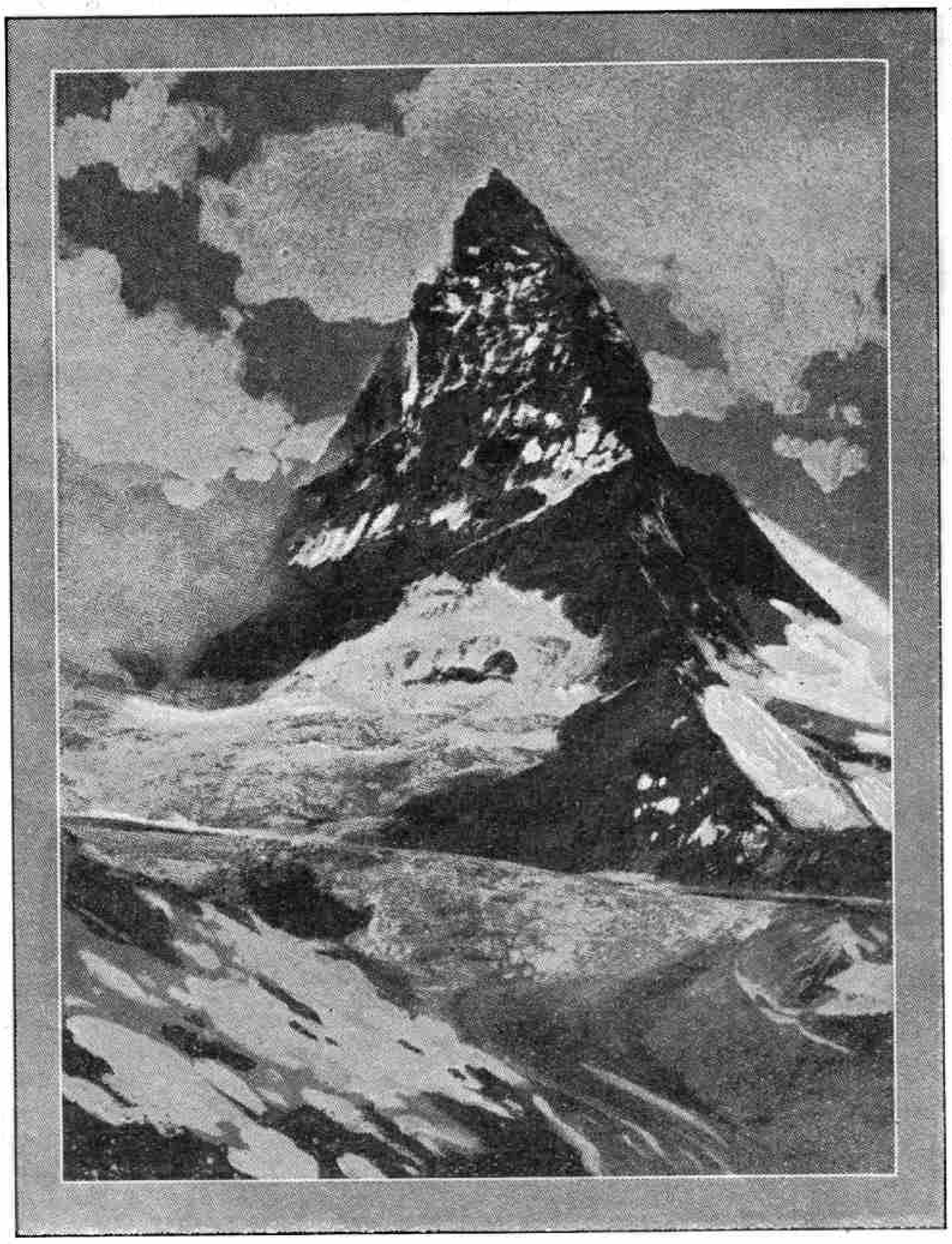
ONE evening, some months ago, whilst reading my paper I saw a name that recalled to my memory one of the most exciting episodes in one of the most interesting books I have ever read. The name was Peter Taugwalder, and the newspaper announced that he had just died at the age of 81 in the mountain village of Zermatt, Switzerland.

To Conquer the Matterhorn

As a boy, I read Whymper's wonderful book "*Scrambles Amongst the Alps*," and it left a most vivid impression on my mind. Edward Whymper was an Alpine climber of repute, and his greatest ambition was to climb to the tops of mountains that had hitherto defied the attempts of other explorers. Although he had many conquests of that kind to his credit, his ascent of the Matterhorn is undoubtedly the feat that marked him as one of the world's most successful climbers.

The day of his victory over the Matterhorn was one of mingled triumph and tragedy. No human being had ever before set foot on the summit of this great mountain monarch, indeed, it was considered that the peak was inaccessible. Many attempts had previously been made, but all had to be abandoned owing to cold, choosing the wrong route, or to the dreadful blizzards that sweep this great peak at almost every season of the year.

In July 1865, after most careful preparation and the closest study to ascertain the best route, Edward Whymper, accompanied by Charles Hudson, Mr. Hadow, Lord Francis Douglas, and three experienced guides, Michel Croz, Peter Taugwalder, senior, and Peter Taugwalder, junior, started out to attack the mountain from the eastern side. It was a perilous ascent, and more than once it seemed as though Nature would again beat them. Finally, however, they gained the summit and planted their flag of victory on the highest peak, where it was seen by thousands of watching peasants in the far-away valleys below.



The Matterhorn (14,781 ft.)

A Terrible Tragedy

The joy of the climbers was intensified when they caught sight of a rival party from Italy who had started out a day or two before from Breuil on the southern side. The Italians were some thousand or more feet below the Britishers, and in his book Whymper tells us that as soon as they saw the British, the Italians turned back disgusted at having lost the race.

After a short rest, Whymper and his party started the descent in high spirits. They were all roped together, and Michel Croz, a sturdy guide of great experience, took the lead. After him came the others in the following order—Hadow, Hudson, Douglas, Taugwalder, senior, Taugwalder, junior and last of all Whymper. A little below the summit they came to a shoulder of the mountain that is doubtless the most difficult point on the eastern face. Here the party proceeded with the utmost care. Michel Croz made the first few steps downwards, and turning round, took hold of each of Hadow's feet and having guided them to a safe foothold, turned to continue his own descent. At this moment a disaster happened that changed triumph to tragedy and threw a gloom over Switzerland that found a mournful echo in our own country.

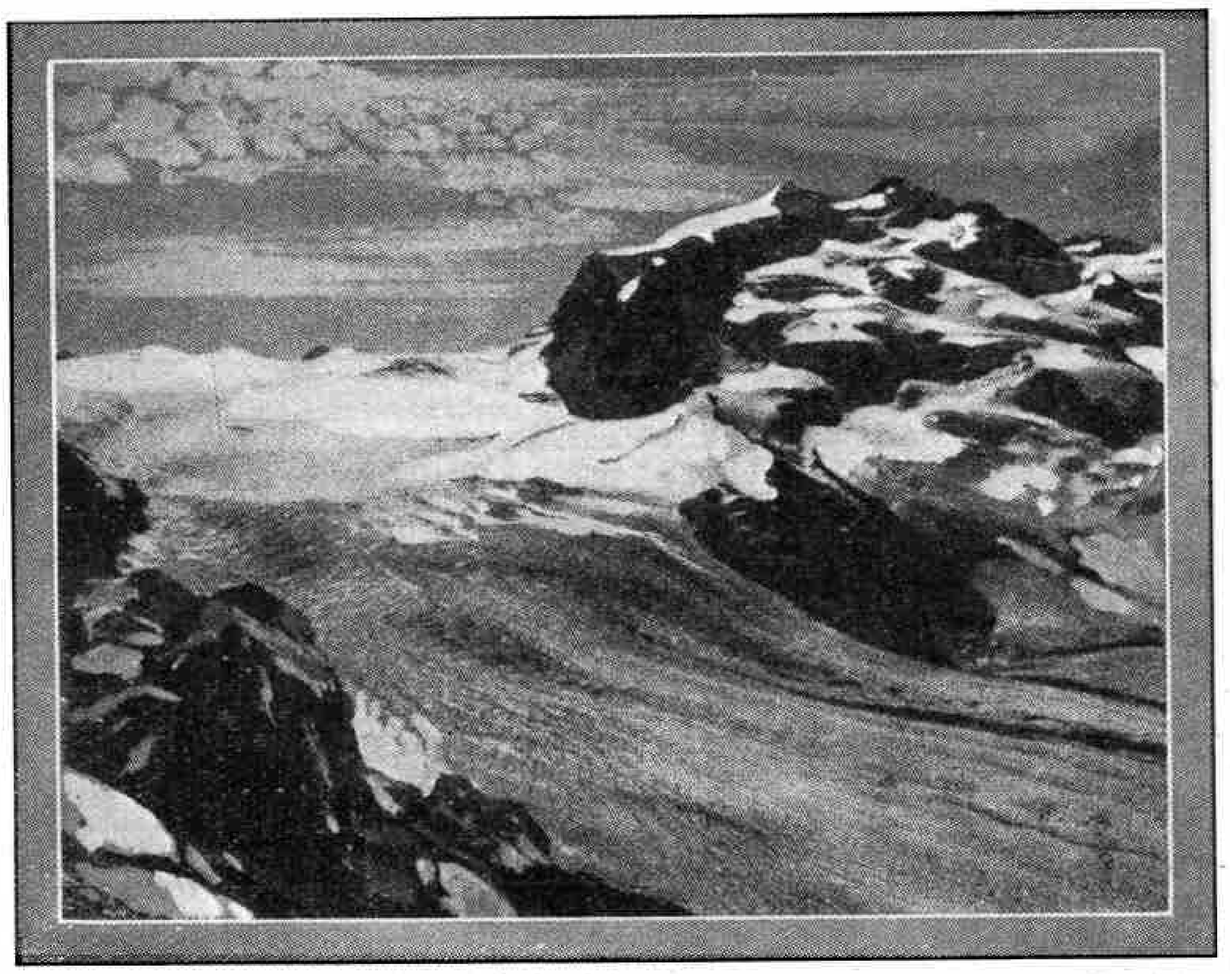
Just how the accident happened will never be revealed, but evidently Hadow slipped and fell with his entire weight on Croz. Hudson and Douglas were unable to withstand the sudden and unexpected strain on the rope, and commenced to fall also. Croz gave a warning cry, and Whymper and the two

Taugwalders, grasping the situation at once, braced themselves for the shock. There was a sickening jerk on the rope. Unhappily it failed to withstand the strain, and broke between Douglas and the elder Taugwalder. The memory of the next few seconds must have scored itself on the hearts and brains of Whymper and his two remaining companions for the rest of their lives. They saw their four comrades sliding down the mountain side at a fearful speed with arms and legs outstretched in a vain endeavour to seize something to save themselves. They fell from abyss to abyss, finding their final resting place on the great Matterhorn glacier, four thousand feet below. What can have been the feelings of Whymper and his two companions at this tragic moment! We can imagine their grief, loneliness, and terror at the awfulness and suddenness of the event.

The Search Party

For half an hour Whymper and his two companions remained where they were, not able to move a step. The two Taugwalders were utterly unnerved and cried like children, calling out "We are lost! We are lost!" At last the elder guide summoned up sufficient courage to change his position a little, enabling him to fix a rope to a rock. They all then descended to the shelf below and stood together. Shortly afterwards they continued the descent, and Whymper tells us that he thought every movement of the next two hours would be their last. The two guides were almost in a state of collapse, and were afraid to proceed, each from time to time exclaiming "I cannot," as they came to the more difficult points.

The party spent the next night on the mountains, and at daybreak resumed their sorrowful journey. On their arrival at Zermatt they aroused the village, and a search party of 20 men was formed to ascend to the glacier. There the party found the bodies of Croz, Hadow and Hudson, which a few days later were buried in the little churchyard in Zermatt. The body of Lord Francis Douglas was never found, and to this day it lies somewhere on the side of the giant Matterhorn buried in eternal snow.



The Monte Rosa

This is a glacier mass lying between Switzerland and Italy and near to Zermatt. It has ten peaks, of which Dufourspitze (15,217 ft. in height) was first climbed in 1855, one of the climbers being Mr. Hudson mentioned in the accompanying article.

The Story of Copper—(*cont. from page* 143)

probably has a great future. All round are evidences that mines in this region were worked by the people of some of the great empires of the dim past. It has been prophesied that the copper mines of Central Africa will ultimately outrival those of the United States in regard to richness of ore and lower cost of production.

British copper production has sunk to negligible proportions, the meagre output coming mostly from Cornwall and Wales. A century or so ago very large quantities of copper were produced in Anglesey, in the neighbourhood of Amlwch, but to-day all mining activity has vanished. The following striking description of the conditions existing in this district when mining operations were in full swing is given by an observer who visited the Parys mine in 1799:—

Mining in Anglesey 100 Years Ago

"This vast natural accumulation of mineral, which measures a mile in length and half a mile over, rises to the south-east of the town (Amlwch), about two miles from it. Its appearance is waste, wild, and barren in the extreme; not a vestige of green is seen on its parched and scarified surface, all vegetation being prevented by the sulphurous fumes which arise from the roasting heaps and smelting-houses and extend their destructive effects for miles round. . . . The bowels of the mountain are literally torn out, and the mighty ruin is subjected to the eye.

"Standing on the edge of the excavation, the spectator beholds an awful range of huge caverns, profound hollows, stupendous arches, gloomy passages, and enormous masses of rock. Amid this striking scenery the miners are engaged in their curious but perilous occupations; some sticking to the sides of the rock, or seated on the narrow ledges of precipices, which gape beneath them to the depth of two or three hundred feet, tearing the ore from the mountain, and breaking it into smaller masses; others boring the rock in order to blast it, whilst a third party are literally hanging over the abyss below them, drawing up and lowering down the ore-buckets, supported only by a frame of woodwork, which quivers like an aspen leaf with the operation carrying on upon it.

"Ever and anon we heard loud explosions rattling through 'the dark profound,' occasioned by the discharge of the gunpowder, and in separating the ore from the mountain. The reports varied, increased, and multiplied amongst the passages and caverns of the abyss, and, united with the scene of rocky ruin below us, excited the idea of the final consummation of all things."

Evidence of this feverish activity is still to be seen, but the mines are silent for ever.

Next month we shall describe the various processes through which the different classes and grades of copper ore are passed in order to obtain the pure metal.

Lives of Famous Engineers—

(*Continued from page* 120)

He was particularly fond of children, and on the occasion of the meeting of the British Association at Plymouth in 1841, certain worthy scientists who called upon him were astounded to find him lying on the floor playing hide-and-seek with a friend's children! His thoughtfulness for others was unfailing, and many of his inventions arose from the desire to lessen the fatigue and labour experienced by those employed on some particular work. He was a firm believer in hard work as being more important than inspiration, and a favourite phrase of his was: "It is very easy to invent a machine, but it is not easy to make it work."

NEXT MONTH:—

I. K. BRUNEL'S EARLY ACHIEVEMENTS

Mint Colonial Stamps

We have received List No. 5 from Mr. Alec Kristich (82, Marchmont Street, London, W.C.1). Mr. Kristich —who has been represented in our pages from the time we commenced to accept advertisements—specialises in mint Colonial stamps, and the list to hand is a comprehensive price list of his extensive stock under this section. Those of our readers who are interested in Colonials will do well to write for a copy of the list, which will be sent post free on mentioning the "*M.M.*"

Giant Block-Setting Cranes—(*Continued from page* 113).

by a method that is interesting. Strictly speaking they were not "dove-tailed" in the manner used in the building of a lighthouse. Instead they were keyed together by cutting semi-circular grooves in their faces, it being arranged that these grooves came opposite to each other in pairs. When the blocks were in position, bags of concrete were placed in these grooves. The action of the water at once caused the concrete to solidify, so that each block had really two concrete pillars holding it in position.

In building a breakwater the engineers are very largely at the mercy of the weather, for naturally no work can be done when the seas are running high. On the other hand, when the water is calm work continues whenever possible during both night and day. At Dover, even on the best days it was only possible to work three hours on each tide owing to the strong currents. Notwithstanding this, in one particular month over 600 blocks were laid, showing a progress of over 75 ft. One of the points that had to be carefully watched was the organisation of the block-making yards. In bad weather they had to be kept free from congestion by unused blocks and in good weather, when the work on the breakwater was being pushed forward with all possible speed, it was necessary to ensure that they were sufficiently well-staffed to be able to cope with the increased demands made upon them and so not delay the work.

In the construction of the first pier at Dover (completed in 1871) only 91 ft. was built during the first 12 months but in the new

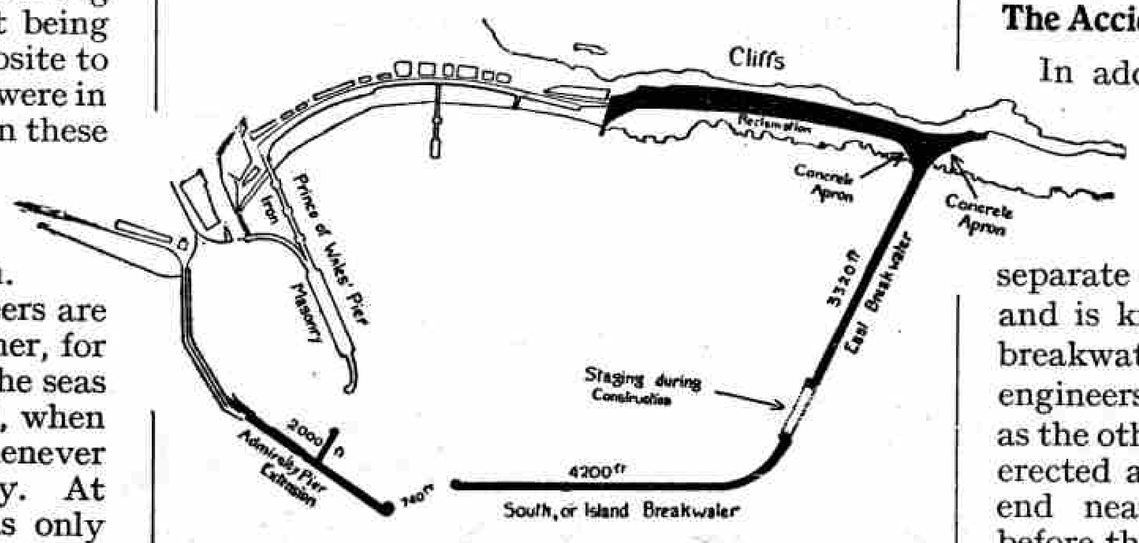


Fig. 2.—The Admiralty Harbour, Dover

The plan shows in solid black the works added recently, as described in the accompanying article

Admiralty Harbour 400 ft. of work was constructed in the same period of time showing how great was the advance in harbour engineering in the meantime. In the new Harbour over 1,920,000 tons of masonry were used and as the blocks averaged about 30 tons in weight, the total number required was about 64,000.

The Harbour works included the excavation of a portion of the cliff and it became necessary to build a retaining wall to protect the exposed chalk. This necessitated over 1,000,000 tons of blocks and masonry, in addition to that required by the breakwater themselves.

The Accident on the Island Breakwater

In addition to the East breakwater and the Admiralty Harbour extension another breakwater had to be constructed to complete the scheme. This breakwater is quite separate from the two former breakwaters and is known as the South-East, or Island, breakwater. In order to save time, the engineers decided to build it at the same time as the other breakwaters. To this end they erected a huge steel frame in the sea at the end nearest to the East breakwater, but before the frame was complete a great storm entirely destroyed it. Six months were required to remove the wreckage, so that instead of gaining time, time was actually lost.

After this disaster, the steel frame idea was abandoned. In its place the trackway used in the construction of the East breakwater was carried on temporary supports across the south-east entrance to the harbour to the Island breakwater. This enabled Goliaths to bring up the blocks for the Island breakwater from the block-setting yards and at the same time allowed the cranes to be withdrawn in bad weather.

(*To be concluded*)

Electricity—(*continued from page* 127)

again as soon as the circuit is broken. A dot is signalled when the lever falls back immediately after the click, and a dash when it makes a slight pause before returning.

Relay introduced by Morse

The strength of an electric current is greatly reduced by the resistance of a long wire, and if two telegraph stations are a very long way apart the current may not have sufficient strength to energise the electro-magnet of the sounder. This difficulty—a very serious one in the early days of the telegraph—was overcome by means of an instrument introduced by Morse and known as a "relay." This instrument consists of a very small electro-magnet that attracts a light bar, the movement of which closes the circuit of a separate battery at the receiving station. The feeble electric current works the relay and thus the strong current in the local circuit comes into play and operates the sounder.

German Electricians Puzzled

The following interesting story regarding the Morse Relay is told in Reid's "*Telegraph in America*":—

"The Morse relay could not be patented in Germany, and therefore could not, with safety, be exposed. In 1848 two young Americans had gone there with Morse machinery, and built a line from Hamburg to Cuxhaven, a distance of ninety miles, for the transmission of marine news. The line worked charmingly, the registers clicked out loud and strong at either end, but the relays were carefully concealed in locked boxes. The German electricians scratched their heads and wondered. Finally, Steinheil was sent forward to reconnoitre. He looked carefully around, and his keen eyes soon detected the locked boxes. He asked to see the locked boxes, but was courteously refused. So he returned and reported that the Yankees kept their secret locked, but that the action was magnificent. And when, at a later date, he did know all, he showed the grand stuff of which he was made. He gave Morse his hand, confessed himself beaten, and the two were friends for ever after."

Recording Messages

By modifying the construction of the sounder this instrument can be made to record the messages it receives. In its simplest form the Morse "inker," as it is called, consists of a small wheel fitted to the free end of the lever of a sounder, with an ink container so placed that the wheel dips into it when the lever is in the normal position. When the electric circuit is closed the lever moves just as in the ordinary sounder, but instead of striking against a stop it presses the inked wheel against a paper tape that is kept slowly and steadily moving forward by means of clockwork. The wheel continues to mark a line along the tape so long as the circuit remains closed, and according to the time during which the sending operator keeps his key pressed down, a long mark or dash or a short mark or dot is produced.

The Passing of a Great Engineer—

(*Continued from next page*)

at the Calcutta Mint. He made yet another important step in his life about this time, when he accepted the position of consulting engineer in India to the Railway Department, and this post he held until his retirement in 1888, at the age of sixty.

It would be impossible to give in these pages even a brief outline of his work during this period in India. That he was a busy man may be gathered from the fact that while he was in India an average of 200 miles of railway was opened each year—the total of one particular year reaching 1,100 miles!

During the Afghan War Molesworth saw much active service, and was nearly captured by the enemy on more than one occasion. In 1882 he was deputed to make an examination of the harbour works at Madras, where he again explored the bottom of the sea in diving dress. During the Burmese War he was ordered, after the capture of Mandalay, to make a survey for a railway from that place to Rangoon, and for the work done on this railway and on the North-West frontier he was awarded the Burma War and Afghan Medals. Finally, it is not surprising to learn that on his retirement he was created a K.C.I.E.

A Last Splendid Act

Returning to England, he settled down at the Manor House, Bexley, but his life thereafter was by no means inactive. His wonderful energy was continually urging him to undertake further work. In 1891 we find him, in compliance with a request made by the British East Africa Company, planning the route of a new railway from the East Coast of Africa to the Victoria Nyanza. Seven years later he was invited by the Foreign Office to visit the line and report on its organisation and progress. He promptly set sail for Africa, and though seventy years of age, carried out his inspection either on foot or on a solid-tyred bicycle!

Even this does not complete the story of his life. On the outbreak of the Great War, Sir Guilford, then in his eighty-sixth year, volunteered for home defence and actually commenced to serve. He was forced to retire, however, on medical orders. Nothing daunted, and urged by his splendid patriotic spirit, he volunteered in the following year as a munition worker, and was employed as a skilled mechanic in the Vickers Works at Crayford. For five months he worked daily from 9 a.m. to 4 p.m., but then his medical advisers again ordered him to retire. Nothing could be more fitting, after a long life of splendid achievement, than this unselfish and whole-hearted service to his country in the hour of her greatest need.

The Passing of a Great Engineer

The Late Sir Guilford Molesworth

THE recent death of Sir Guilford Molesworth has both deprived the world of one of its greatest engineers and terminated a very full and extraordinarily useful life. Guilford Lindsey Molesworth, the fifth son of the Rev. J. E. N. Molesworth, D.D., was born on 3rd May, 1828, and was thus nearly 97 years of age at the time of his death. Though Meccano boys may not be familiar with many details of his life, owing to his great age and to the fact that he retired from active work as long ago as 1888, yet many must have heard of Sir Guilford's well-known work published as "*Molesworth's Pocket Book of Engineering Formulæ.*"

A Famous Book

This became a classic among engineering books of reference, and now consists of 950 pages, although it contained only 220 when first published in 1862. Actually, Sir Guilford started his book many years before that date—in fact he had made a habit all through his life of writing down in a book anything that particularly interested him or appeared unusual. As may be imagined this notebook grew to a great size, and it was then that the idea came to him to print the data he had collected as a book of convenient size, so that it might be circulated and that posterity might benefit from his own experiences.

At the age of sixteen Molesworth was sent to the College of Civil Engineers at Putney. He is credited with saying later that although he left the College feeling perfectly satisfied that he had learnt all there was to know about engineering, he began to find before he had been very long in actual practice that there were *some* things that he did not know, and that as time went on the number of those things increased in a marvellous manner!

"And now," he concluded, "after a long professional career I have achieved a knowledge of my own ignorance, and a conviction that the education of an engineer is never complete."* This remark admirably shows Sir Guilford's attitude to his chosen profession, and may even contain the secret of his success!

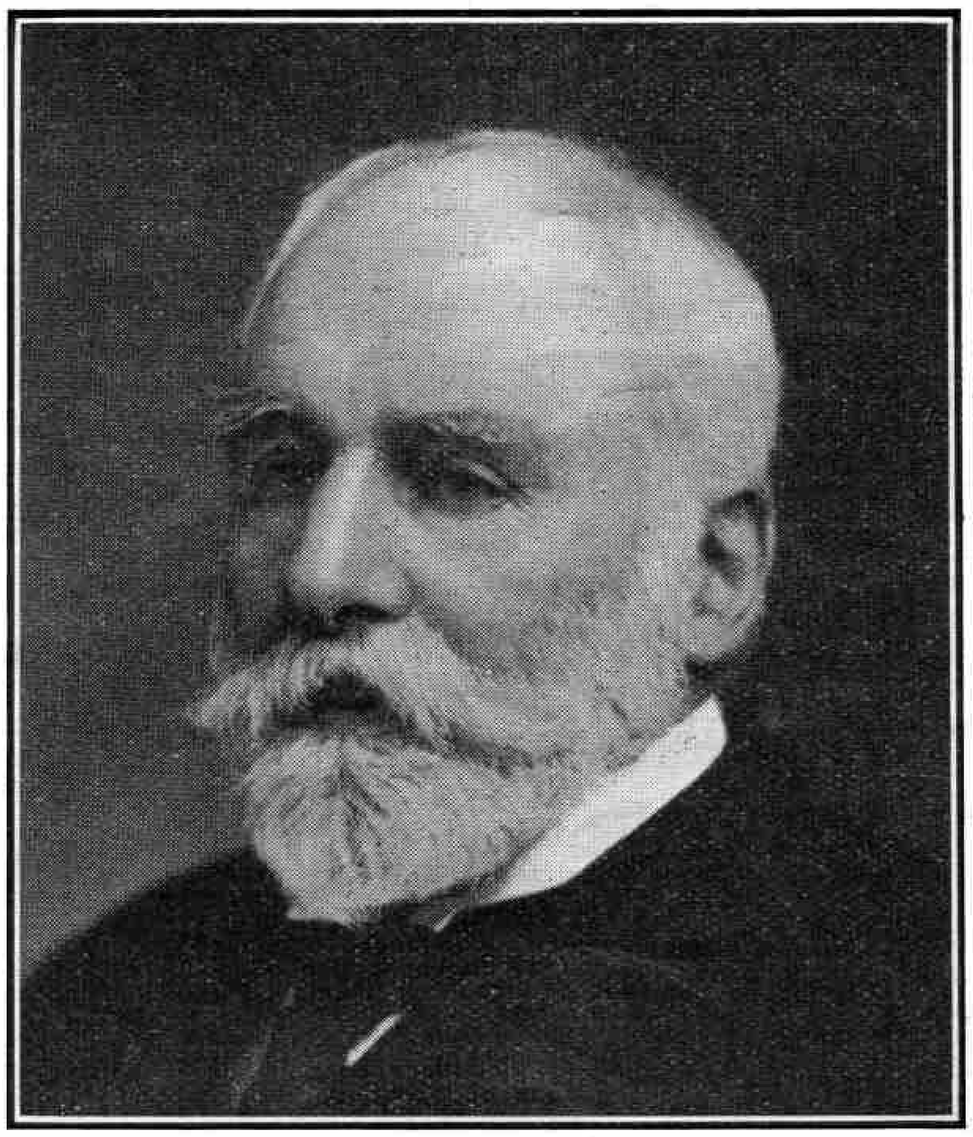
Millwright and Fitter

From the college he was sent as an articled pupil to Mr. R. B. Dockray, the Chief Engineer of the London and Birmingham Railway, and although still quite young was quickly made Assistant Engineer. His father then apprenticed him to Sir William Fairbairn, however, in order that he might gain practical workshop experience, and in Sir William's workshops at Manchester he was employed as a millwright and later as a fitter.

* "*The Life of Sir Guilford L. Molesworth,*" edited by his cousin Miss E. J. Molesworth.

At the age of twenty-one he was sent to Portugal to erect an engine for driving a cotton mill, and returning to England he built a 240 horse-power pumping engine to drain a deep coal mine.

Later, during 1849–50, young Molesworth acted as chief assistant in South Wales to Mr. Doyne, who had known him when he was on the London and Birmingham Railway. From here he was appointed Chief Assistant Engineer on the London, Brighton and South Coast Railway. At the outbreak of the Crimean War he accepted an important post in Woolwich Arsenal, which he held for a short time until going into partnership as a consulting engineer in London.



Courtesy ["*The Engineer*"

The Late Sir Guilford Molesworth

In 1859 his former chief in South Wales, Mr. Doyne, who had since become Chief Engineer to the Ceylon Railway Company, advised his directors to make Molesworth their Mechanical Engineer and Locomotive Superintendent. Molesworth, then only thirty-one, accepted the position and left England that year. In Ceylon a new railway had been proposed between Colombo and Kandy, but Mr. Doyne, dissatisfied with the survey and estimated cost, suggested the employment of a rope incline instead of an adhesion line. He was sent to England to consult Robert Stephenson in the matter, but Stephenson died before he could send in a report. Molesworth, acting as Chief Engineer while Mr. Doyne was away, meanwhile decided to make a survey of the proposed line himself. He found that by using a different route it would be possible to build an adhesion railway at a much less cost than the first estimate. For some time nothing was done however, and in 1861 Molesworth set sail for home. There followed a short period of comparative leisure, but in November 1862, he was recalled unexpectedly to Ceylon, for the Government of that country had decided to construct the Colombo-Kandy line according to his plans.

Molesworth Saves a Train

On his arrival he was told to proceed with the line—which, it may here be mentioned—was eventually completed for practically the amount of his estimate.

It was on this line that an exciting incident occurred that nearly cost his life, and perhaps the lives of many others. The Duc de Brabant, who was afterwards the King of the Belgians, had visited the Governor at Kandy and was returning to Colombo. The train in which he was travelling in company with a number of British officials was driven by Molesworth himself, and since there was no turntable available the engine had to proceed tender first. Whilst running at considerable speed down a steep gradient the engine rounded a curve, and Molesworth's horror may well be imagined when he saw, not far ahead, several large stones laying right across the rails! He realised it was impossible to stop in time, and that if he struck the stones at his present speed the train would most certainly be derailed, for the tender was not provided with a guard such as a locomotive carried. But he immediately seized his only chance, therein revealing his coolness and self-possession. He did not attempt to slacken, but instead opened the regulator to its fullest possible extent. With a roar the engine leaped down the incline at a tremendous speed, and reaching the stones thrust them aside with the force of the impact, and the train passed over safely. Many years later the Royal passenger was told—for the first time—of the narrow escape he had had!

Decimal Coinage for Ceylon

Soon after this, Molesworth was made Director-General of Railways and Director of Public Works in Ceylon, and this post, as may be imagined, entailed a great amount of work in all branches of engineering. Railways, roads, harbours, water-supply and irrigation schemes all claimed his attention. Whilst superintending the removal of rock from the bottom of the harbour at Galle, he made several excursions in diving dress 40 ft. or so below the surface.

A further valuable service he rendered the island was the institution of a decimal coinage in 1871, when he personally designed the first set of coins to be struck

(*Continued on previous page*)

The Story of Metals

II COPPER.

IN last month's issue we gave an outline of the early history of copper and of the value and uses of the metal. We must now turn to the actual mining of the various copper ores.

Vast quantities of copper come from the United States, principally from Montana, Michigan and Arizona. The Montana copper mines came into existence as the result of a rumour in 1880 that gold was to be found in the Butte district. This rumour was immediately followed by the usual rush of prospectors, but very little gold was found. Copper was there in abundance, but the prospectors were not interested in this metal, and as soon as they found that there was no gold they quickly left in disgust to try their luck elsewhere.

A Far-Sighted Irishman

One man alone, an Irishman named Daly, realised the immense value of the copper ore, and when the prospectors began to depart he bought for next to nothing the three biggest copper claims. He was regarded as a lunatic for doing so, but he knew what he was about, and from these three claims were developed three of the greatest copper mines in the world, one of them being the famous "Anaconda" mine.

Daly lost no time in beginning mining operations. He obtained the necessary labour and drove underground galleries in all directions, extracting the ore as it was found. From a small beginning the number of miners employed increased to 10,000 or more, and the quantity of ore produced reached the immense total of some 15,000 tons per day.

Fumes from Smelting Plant

Daly's next step was to provide means for smelting the ore from his mines, and in 1883 he established smelting works at Anaconda, about a mile from Butte. At first this smelter was able to keep pace with the amount of ore produced, but before long another and considerably larger plant had to be set up on a neighbouring hill.

World's Production of Copper in 1923

	Metric Tons*
NORTH AMERICA	
United States	684,540
Mexico	54,920
Canada	36,496
Cuba	10,853
SOUTH AMERICA	
Bolivia	10,654
Chile	203,256
Peru	43,856
EUROPE	
Austria	1,540
Germany	17,000
Norway	8,000
Russia	2,000
Spain and Portugal	51,815
Sweden	4,700
Serbia	6,837
ASIA	
Japan	63,790
Rest of Asia	1,000
AUSTRALASIA	17,946
AFRICA	73,909
OTHER COUNTRIES	7,000
Grand Total	**1,300,112**

World's Consumption of Copper in 1923

United States, 663,262; France, 117,000; Great Britain, 95,000; Germany, 93,100; Japan, 70,200. Total:—1,210,362 tons.

*A Metric ton = 2,204.6 lb.

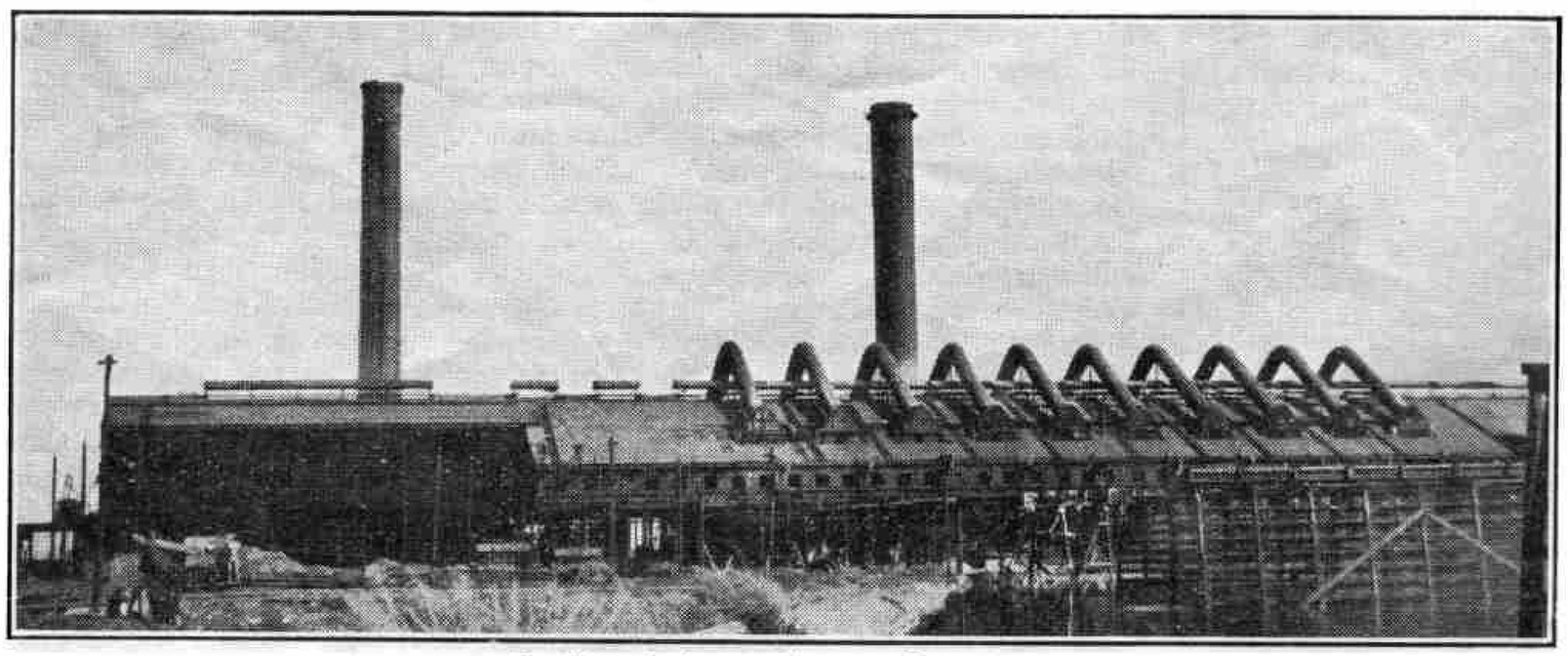
Daly's interests at Butte and Anaconda were subsequently acquired by a Copper Combine for the enormous sum of £10,000,000, and smelting developments proceeded with great rapidity until the plant became the largest of its kind in the world.

This development was not carried out without difficulty. In the process of smelting copper, clouds of fumes are given off which have a most disastrous effect upon the surrounding vegetation. It was not long before the agriculturists of the district began to complain that their crops were being severely damaged and that their cattle also were suffering, and they set up heavy claims for damages. A prolonged legal struggle ensued which cost the copper combine enormous sums of money. The attempt of the farmers to have the smelting operations stopped was unsuccessful, but on the other hand, in spite of all efforts on the part of the combine, it was not found possible to eliminate entirely the nuisance of the fumes.

Mining Low-Grade Ore

Copper mining on a vast scale is also carried out at Bingham in the State of Utah. Bingham was formerly famous for its gold and silver mines. After a time the rich lodes became worked out, and although everybody knew that there was copper in abundance, the ore was of such low grade as to be considered unworkable at a profit. Presently a mining engineer of specially keen intelligence came along and saw that this ore, low grade as it was, could be made to pay if treated on suitable lines, and after buying out the claims of the gold company he commenced work in earnest. A new company was formed and was so successful that in about 15 years from the commencement of operations the shareholders received no less than £5,000,000 in dividends!

The miners cut their way into the hillside on a gigantic scale by means of powerful steam shovels, the whole operation being on the lines of quarrying rather than mining in the ordinary sense of the term.



In the Arizona Copper Country

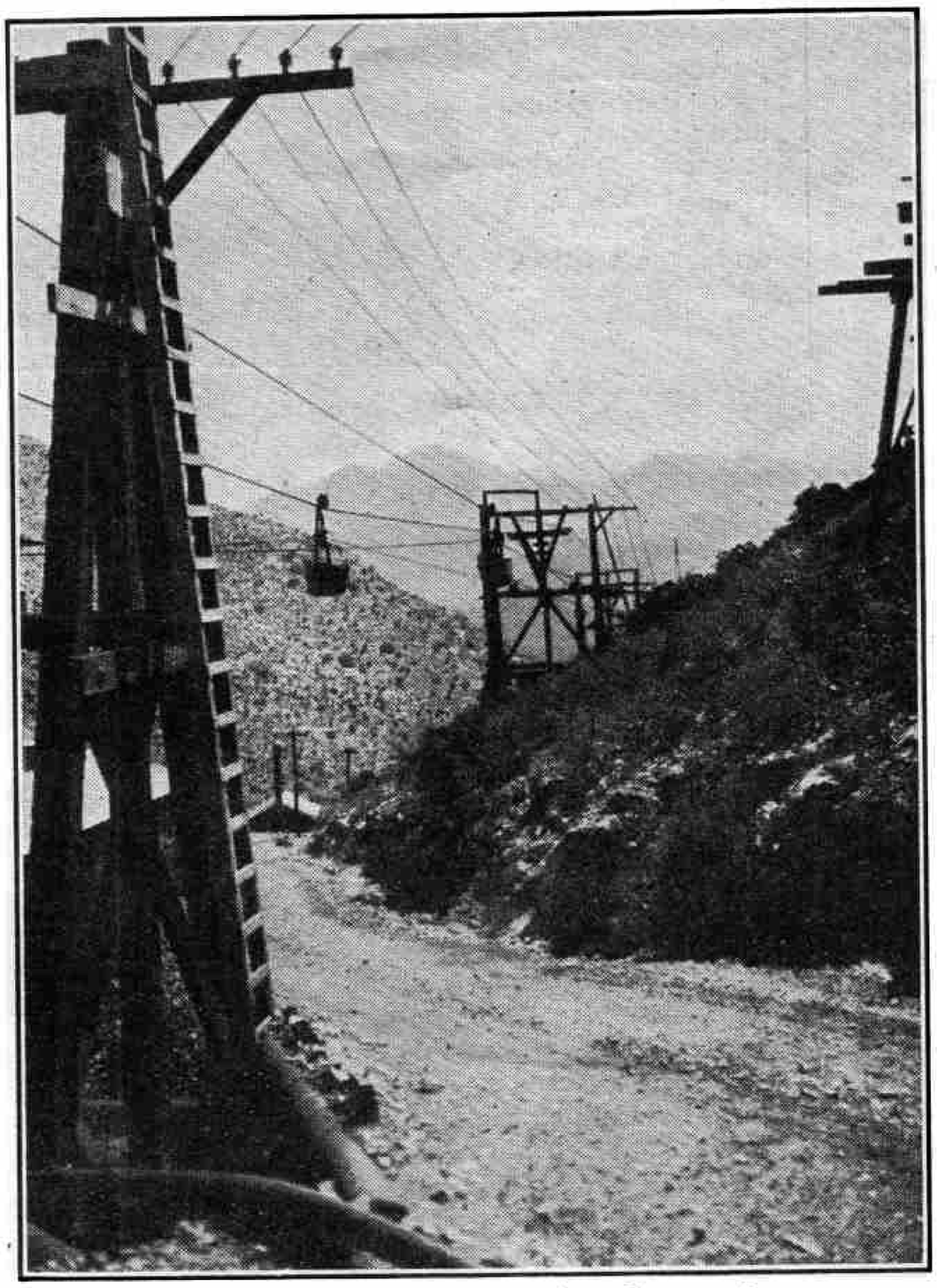
Our photograph shows the Copper Queen smelter at Doughlas, Arizona, where vast quantities of ore are smelted every year

In this way vast quantities of ore were torn out of the earth. A smelting plant was established about 20 miles away and a railway was laid down to convey the ore from the mine to the smelter.

Mineral Wealth of Lake Superior Region

The vast mineral wealth of the Lake Superior region must have been known at a very remote period of history. As the country came to be opened up in modern times it was found that there existed indisputable evidence of ancient workings. In the course of mining operations pits were discovered penetrating as far as 50 ft. into the solid rock, and all round were signs showing the activity of these long-forgotten miners of antiquity. In particular, large masses of copper were found that apparently had been too heavy for the ancient miners to handle. In 1760 a huge mass of copper was discovered, so large that at first it defied all efforts to remove it. In 1842, however, an expedition succeeded in removing it and it was sold to the United States Government and placed in the grounds of the War Department at Washington. Later an even greater mass of copper was found, containing something like 500 tons of the pure metal. It was, indeed, so massive that twenty men were occupied for a year and three months in moving it piece by piece!

After about the middle of last century, copper mining developments proceeded rapidly and some of the most remarkable mines in the world were opened up. Enormous shafts were sunk, some of them being a mile in depth, and from these shafts the lodes were worked to distances as great as two miles. Engines of tremendous power were installed to lift the ore to the surface and to drive the great fans necessary for the ventilation of the shafts.



Aerial Line for Transporting Copper Ore

Copper ore from the Shattuck mine, Arizona, is transported by a three-mile aerial cableway to Bisbee, from whence it is shipped to the smelters

The Rio Tinto Mine

The story of copper mining in the Rio Tinto region of Spain is particularly interesting. The mineral wealth of Spain was known ages ago to the Phoenicians, who carried out gold mining operations on an extensive scale. At a later date the Romans sent thousands of unfortunate captives to toil in the mines, and the wealth of Rome at the height of its glory was largely derived from this source. From the time when the power and greatness of the Roman Empire began to decline, the Spanish mines fell into disuse, and for some centuries they remained more or less idle. Even in the days of Spain's greatness as a maritime nation the mineral wealth at home was practically ignored, while people were willing to face all kinds of difficulties and danger in order to reach the then newly-discovered mines of Mexico and Peru.

Mr. W. R. Lawson, in his interesting book "*Spain of To-day*," writes: "It is a strange example of the irony of history that, when Columbus sailed on his first voyage to America, he left behind him, within 50 or 60 miles of the fishing port he sailed from, mineral deposits which were destined to produce a more famous mine of its kind than has yet been discovered across the Atlantic. The dark waters of the Rio Tinto, on which his pioneer ships floated out into the unknown ocean, owe their colour to a mountain of copper."

Early History

The early history of mining operations in the Rio Tinto region is wrapped in obscurity, but we know that from about the middle of the sixteenth century various Spaniards attempted to work the deposits, generally with little success. The first man to tackle the problem on serious lines was a Swede named Wolters, who leased the mine from the Government in 1725. He had little difficulty in forming a company to provide the necessary capital, but unfortunately he fell out with the shareholders and had accomplished very little at the time of his death.

The property then passed to his nephew, who was so handicapped by legal disputes that his efforts at production were also entirely thrown away. After this the Spanish Government worked the mine, but with very poor results, and it was not until 1873 that real progress commenced, when the mine was acquired for £3,712,000 by an Anglo-German financial group.

From that time steady progress was made and the mine was developed until it became the largest in the world, covering an area of about eight square miles. The working was carried out partly by quarrying into the hillside and partly by driving tunnels into the rock.

Description of the Mine

To quote again from "*Spain of To-day*": "The area of the mine is covered from end to end with masses of red and grey earth looking like gigantic ash-heaps. A few of these are the natural hill-tops, which it has not been thought worth while to remove; but most of them are artificial mounds formed during the operations of the mine. That towering mass of broken slate and granite in the distance was made by the Romans, whose implements and domestic utensils are found in it to the present day. That high embankment of blood-red clay and porphyry, with two lines of railway running along the top of it, is 'overburden.' It represents millions of tons' weight, and has been carried miles away from where Nature placed it. In the hollow below there is as much slag or cinder from the blast-furnaces as would pave all London, and it is but a fraction of what the furnaces have turned out. Every year thousands of tons of it are put on the railway as ballast, and wherever a chance occurs it is made away with, but still it goes on growing. . . . .

"Rio Tinto was wild and desolate enough when the copper miners laid hold of it, but that was grace and beauty compared with what it is now. Pluto himself, lurid as his fancy is supposed to be, could not have conceived the idea of such a scorched, scarified, and grimy wilderness as it has since become. It is pandemonium painted red and set out to roast in a blazing sun. . . . The terraces (of the open-casts) are traversed by nearly sixty miles of railway, on which more than thirty locomotives and 750 wagons are running daily. From one end of the workings to the other is a journey of seven or eight miles, curving in and out of hollows, crossing points, running up one slope and down another, and your engine all the while shrieking to signalmen at every few hundred yards. Walking is out of the question in such a country."

Australian and African Mines

Large quantities of copper are produced also in Australia, notably at the Mount Lyell mine in Tasmania. This mine is situated in mountain wilds far from any centre of industry. Its surroundings furnish a striking example of the evil effects of the fumes resulting from copper smelting. The trees that formerly covered the mountain slopes have vanished, leaving only dead and blackened stumps, and vegetation of all kinds is practically exterminated over a considerable area. At Mount Lyell the copper is won largely by quarrying operations from an enormous open mine. Queensland also produces a large amount of copper and the output from this region is growing steadily as means of transport improve.

Other great copper-producing regions are situated in Japan, Chile, Mexico, Canada and Africa. The African copper field, which is situated near Lake Tanganyika in the heart of the continent,

(*Continued on page* 139)

The Secretary's Notes.

The Spring Session

Now that Spring is approaching it is time to be thinking of Outdoor Sports for the coming season, and all Leaders and secretaries should be making arrangements for their clubs. Cricket fixtures should be drawn up in good time, otherwise it will be found that local clubs are booked up and there will be little opportunity of securing a good fixture list. Delay may even result in not having enough games to carry through the season. If it is proposed to form a Cycling Section, every effort should be made to get the members together and map out the programme for at least the first part of the season. It will be found that members will be much more enthusiastic when a definite programme has been arranged, as they will then know exactly what is going to take place. It may happen that some members are more keen on walking tours and do not wish to take part in Cricket or Cycling. In these cases walking expeditions may be arranged to take place once a week, when the surrounding country can be explored.

Making Plans Early

It cannot be too strongly emphasised that now is the time to hold a conference to discuss all outdoor amusements. If matters are left until the Summer comes it will be found that many boys have taken on something else and cannot spare the time. A club that has its programme made out beforehand and run in a business-like manner will always be found much more flourishing than a club run in a haphazard manner. Whatever game or recreation it is decided to take up, make your arrangements now. It is rumoured that we are to have a really good Summer, the Sun having just recovered from a two years' chill!

Club Camps

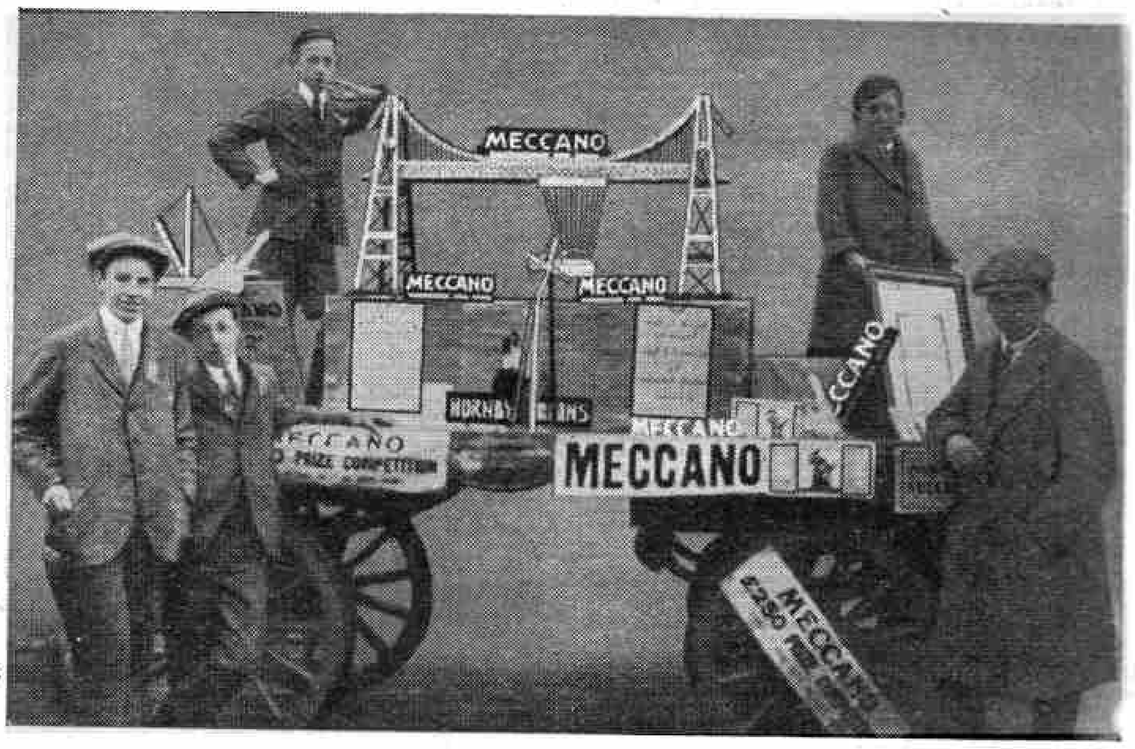
I should like to take this opportunity of suggesting to Club Leaders that they should seriously consider the question of a Club Camp sometime during the Summer. The majority of boys have their Summer holidays at approximately the same time and—provided, of course, that the Leader is able to fit in part of his holiday—there should be little difficulty about obtaining the necessary members for the camp. A camping holiday, given reasonably good weather, is not only ideal from the point of view of health and outdoor pleasure of the best type, but it also has another great point in its favour—it results in those taking part getting to know one another's real characters in a way that might take years under conditions of ordinary living.

Camps Promote Good Fellowship

The experience of those Leaders who have taken their club members to camp, even if only for a very short period, has been that the club has received a very great increase in strength and vitality. The close companionship of camp has broken down any barriers that previously may have existed between various sections of the club and has produced a new spirit of enthusiasm that has resulted in marked progress in every branch of the club's work. In addition, a short period in camp enables Leader and boys to appreciate one another's good points, and produces a feeling of mutual trust and confidence, the value of which cannot be over-estimated. Those clubs that have cycling sections can get further afield than those who depend only on "shanks' pony," but in either case there is a great deal of healthy fun to be obtained from even a long week-end "under canvas."

During the past year I have noticed a growing tendency among the larger Meccano clubs to form sections devoted to individual subjects. In almost every case where this policy has been adopted the result has been to strengthen the club in every respect, and next month I intend to deal with this interesting subject in some detail.

Ellesmere Port M.C.



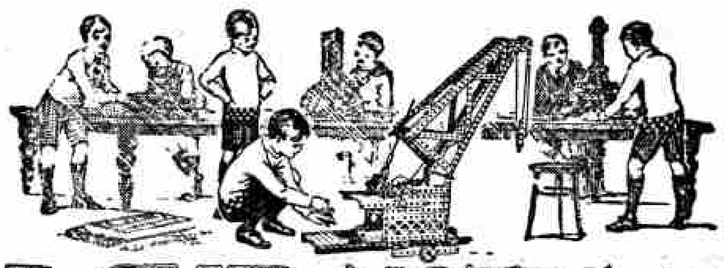
The Ellesmere Port M.C. took full advantage of a local Procession and Fête to gain more members for their club. A lorry cleverly decorated with Meccano Models, including Dutch Windmill, Crane, Aeroplane, Meccano Family and other models, was entered in the procession. This attracted considerable attention, and although the club did not receive a prize their exhibits were greatly admired, as was shown by the size of the crowd that assembled around the lorry while the judging was going on.

The Ellesmere Port Club was started in February 1924, and became affiliated with the Guild in April of the same year. The club's success is largely due to the splendid Leadership of Mr. G. Hyde, who takes a keen interest in the boys and in Meccano Model-building, and also to the enthusiasm of W. H. Hope, the secretary.

Affiliated Meccano Clubs of the British Isles

Second List

Town.	Club.	Secretary.
ALLOA (SCOTLAND)	CHALMERS CHURCH M.C.	Wm. Henderson, 13, Paton Street.
BIRMINGHAM	HANDSWORTH M.C.	N. J. Robertson, 30, Henstock Road, Handsworth Wood.
CHARD (SOMERSET)	CHARD M.C.	Wm. Sanders, Stanford House, Upper Combe Street.
CHELMSFORD	GREAT BADDOW M.C.	G. T. Kemp, 5, King Edward Terrace, Beehive Lane, Baddow Road.
HARWICH	HARWICH M.C.	A. E. W. Ward, Osborne House, Pepys St.
LINCOLN	WASHINGBORO' M.C.	T. Smith, 3, Stamford Villas, Washingboro', Lincs.
PEEBLES	PEEBLES M.C.	Andrew Ker, 1, Ker Place.
WOLVERHAMPTON	DUDLEY M.C.	Leader: Mr. L. Lewis, 2, Thornley Street.
	LONDON AND DISTRICT	
BARNSBURY	HOLY TRINITY M.C.	S. A. G. Bone, "The Rosary," Kents Hill Road, South Benfleet.
HORNSEY	STATIONERS' SCHOOL M.C.	Master Greenway.
ILFORD	SOUTH PARK M.C.	N. Tweddell, 103, Breamore Rd., Seven Kings
LEWISHAM	ST. MARK'S M.C.	G. C. Green, 21, Hafton Rd., Catford, London, S.E.6.
NEWINGTON	ST. MARY (NEWINGTON) M.C.	Mr. C. A. E. Curle, 37, Pullen's Flats, Peacock Street, London, S.E.11.
RICHMOND (SURREY)	RICHMOND M.C.	E. J. C. Smith, 70, Lower Mortlake Road.
RUISLIP COMMON	RUISLIP COMMON M.C.	L. Ive, Chestnut House, Ruislip Common.
SOUTHALL	SOUTHALL M.C.	(Leader) Mr. E. C. Carpenter, 56, Hammond Road, East Southall.
SURBITON HILL	SURBITON HILL M.C.	A. G. Eley, 102, Tolworth Park Rd., Surbiton.



CLUB NOTES

Harwich M.C.—Excellent progress has been made and affiliation with the Guild was granted in January. The Leader, Mr. Hogg, recently gave a lecture on "Art," at which a number of his paintings were shown. Parents and friends were invited to this lecture and this has been the means of impressing many people with the great advantages of a Meccano Club. The session's programme includes Lectures, Model-building, Table Tennis and an Exhibition. *Secretary*: E. W. Ward, Osborne House, Pepys Street, Harwich.

Grimsby Central M.C.—Session commenced with a talk by Mr. Gibler, the Leader, in which he complimented the boys on the way they had worked together during the previous session. Special Merit Medallions have been awarded to H. T. Christian and J. H. Boreham for the best lecture and best all-round work respectively. The Vicar of St. John's Church, Grimsby, has kindly allowed the Club to insert a notice every month in the Parish Magazine. It is proposed to hold an exhibition shortly. Club roll: 31. *Secretary*: J. H. Boreham, 277, Cleethorpes Road, Grimsby.

Claygate Juvenile M.C.—Good progress is maintained in the boys' section with Model Engineering and Carpentry, and in the girls' section with Needlework and Knitting. A Whist Drive was recently held, the proceeds of which went towards a "Tea Party and Entertainment" for the old people of Claygate. Club roll: 86. *Leader*: Mr. J. W. Haynes, "Fontmell," Covers Road, Claygate, Surrey.

1st Herne Bay M.C.—Some splendid "table games" have taken place, and competitions have been held and prizes given. A musical evening was given by the members when Master C. W. Russell played his violin and other members played quite well on mouth organs. The rifle range is still as popular as ever and some excellent shooting has taken place. Club roll: 13. *Secretary*: C. W. Russell, 4, Clifton Villas, Herne Bay.

Holy Trinity (Barnsbury) M.C.—As a result of experiments carried out last session the sections have been revised, and now consist of Model Railway Building, Engineering, Fretwork, Radio and Motor and Dynamo construction. Each section has its own particular officer. Many of the articles made are to be sold and the profits devoted to buying further material or towards stocking the Club's stall at the annual Sale of Work. Other activities include a Concert, "Esperanto" Classes and Club outings at Easter and Whitsuntide. Special Merit Medallions have been awarded to A. Smith and W. Kebell for the best lecture and the best all-round work respectively. Club roll: 30. *Secretary*: S. A. G. Bone, The Rosary, Kents Hill Road, South Benfleet, Essex.

Parkstone Congregational M.C.—Mr. Carlile, the Leader, has unfortunately been obliged to resign, but it is hoped to get another Leader shortly. In the meantime the members carry on with Model-building and Sports. Club roll: 10. *Secretary*: E. J. Street, Bradley, Sandbanks Road, Parkstone, Dorset.

Rosyth M.C.—A Club Magazine has recently been published and it is expected that it will have a good circulation in the district. Mr. Stannard, the Leader, has resigned, and Mr. Cook has now undertaken the Leadership. Club roll: 9. *Secretary*: E. F. Hunter, 79, Admiralty Road, Rosyth, Fife.

West View (Nottingham) M.C.—Prospects are very bright. A good programme has been drawn up including Model-building, Speed Competitions, Wireless Lectures and making Wireless Sets, Stamp Collecting and Lectures on Famous Men. It is proposed to form a special section for Wireless, and possibly other hobbies, for the members who wish to press forward in any particular branch. Club roll: 28. Leader: Mr. H. W. Cousens, 494, Mansfield Road, Sherwood, Nottingham.

South Park M.C.—A successful exhibition has been held in the School Hall, and the two models which reached the highest standard of efficiency were Mechanical Navvy and Loom. In addition to Model-building the Club has Electrical and Fretwork Sections in which some very good work has been produced. Club roll: 42. *Secretary*: N. Tweddell, 103, Breamore Road, Seven Kings, Essex.

Buckfastleigh (Devon) M.C.—Is unfortunately without a Club room. In the meantime members have carried on a strenuous recruiting campaign which has resulted in gaining 20 new members. Club roll: 46. *Secretary*: H. J. Parsons, Bell Cottage, Buckfastleigh, Devon.

Boroughmuir School M.C.—Has held a successful Exhibition at which the principal exhibits were a Model Railway Layout, Wireless Sets of all descriptions, and Woodwork. A splendid scheme of decoration was carried out which assisted in attracting visitors, who paid a penny for admittance. Altogether £3/6/0 was taken, half of which went to the Children's Hospital and the remainder to the Club. The Club's Jazz Band is to be revived this year with the addition of two violinists. Club roll: 42. *Secretary*: J. D. Watson, 1, Alvanley Terrace, Edinburgh.

Chalmers U.F. Church (Alloa) M.C.—Is making good progress under the leadership of Mr. J. Meins. Recently a musical evening was held at which a few kind friends presented the Club with a sum of money to give all the members a treat. Club roll: 24. *Secretary*: W. Henderson, 13, Paton Street, Alloa, Scotland.

Boston (Lincs.) M.C.—Members are preparing for an Exhibition to take place early this month. Recent activities include Model-building, Fretwork, and a Social at which several visitors were present and a most enjoyable evening was spent. Club roll: 30. *Secretary*: R. Robinson, 30, Woodville Road, Boston, Lincs.

Meccano Club Leaders

No. 19. Mr. J. W. Haynes

The Claygate Juvenile Club, of which Mr. J. W. Haynes is the energetic Leader, was started in 1919. At first the members paid a subscription of a penny per week, and the meetings were held in the Council School Room. As the membership grew, concerts and sports were arranged in order to raise funds to build a hut in which to hold meetings. These efforts succeeded so well that to-day the Club has a large hut of its own, lighted by gas and fitted with forms and tables and carpenter's benches and tools. It may be mentioned also that the Club possesses a small but useful banking account.

The Club was originally known as the Claygate Meccano Club, but after a girls' section was started in 1921, under the superintendence of Mrs. Haynes, the name was changed to the Claygate Juvenile Club. Meetings are held every evening for both boys and girls, the former occupying themselves with model engineering and carpentry, and the latter with needlework and knitting. The Club now has a total membership of 86.

In addition to his Club Leadership Mr. Haynes holds other offices in the village, being a member of the Esher and Dittons Urban District Council, Superintendent of the Church Sunday Schools, and, since the war, a Special Constable.

St. Mark's (London S.E.) M.C.—Owing to Mr. W. F. Cross, the Leader, being unable to attend meetings regularly through pressure of business, Mr. Simmons has kindly consented to act as deputy Leader. At the commencement of the Session the Club was re-modelled. A new committee was formed and the rules were revised. Club roll: 23. *Secretary*: G. C. Green, 21, Hafton Road, Catford, London, S.E.6.

Bearwood (Birmingham) M.C.—At a recent Social a debate on "Which is the safest side of the road?" took place. Those in favour of the "left side" won by a big majority. Following the debate two boys read lectures and the evening finished with games. Many visitors were present at the Club's Exhibition and quite a good profit was made. Club roll: 45. *Secretary*: C. White, 72, Katherine Road. Bearwood, Birmingham.

Handsworth (Birmingham) M.C.—Wireless and Transport Sections have been formed and are well supported. The following activities are being carried out in each section:—Meccano—Model-building; Wireless—Making a Crystal Set to send to a sick boy in Edinburgh; Transport—Constructing a Model Railway. The Club has recently become affiliated with the Guild and promises to make good progress. Club roll: 19. *Secretary*: N. J. Robertson, 30, Henstock Road, Handsworth Wood, Birmingham.

St. Mary (Bourne) M.C.—The second session opened with an Exhibition and Entertainment which proved a great success. The hall was packed with people, many having to be refused admission. Mr. Evans, the Leader, gave an address, and Capt. Purvis, R.N., was the chairman. Further activities included Games and Meccano Model-building, and parents were invited to inspect the models constructed. Club roll: 18. *Secretary*: Master D. L. White, "Rosedale," Stoke, nr. Andover, Hants.

Richmond (Surrey) M.C.—Recently held an Exhibition and Concert in aid of the Club funds and the Sunday School. Some excellent models were shown, including one of a pumping engine, constructed by N. S. Dunno. W. Kenneth supplied a Meccano set for exhibition. One of the principal items in the Concert was the Meccano Play, "Nonsense Nana," which was highly appreciated. The Rev. E. B. Greening during the evening spoke on the successful progress of the Club, which was affiliated with the Guild last November. Club roll: 13. *Secretary*: Master E. J. C. Smith, 70, Lower Mortlake Road, Richmond, Surrey.

1st Herne Bay M.C.—Speed contests in Model Building have become a great feature, and recently a member built a small Truck in two minutes, thereby winning a prize. Club roll: 27, an increase of 8 in a month. *Secretary*: Clifford W. Russell, 4, Clifton Villas, Herne Bay.

South Africa

Malvern M.C.—The annual Garden Fête organised by the Club was a great success, and in spite of unfavourable weather a total of over £70 was raised. By arrangement with the Fête Committee the Club was entitled to fifty per cent. of the proceeds, but they generously returned half of their share so that the Malvern Homes benefited to the extent of nearly £53. A "Christmas Tree" was held at the Epworth Home at which ninety people were present, and the Club gave presents to all the children in the Home. Club roll: 38. *Secretary*: C. Gunnell, 177, St. Frusquin Street, Malvern, Johannesburg, S. Africa.

Clubs not yet Affiliated

Koffiefontein (S. Africa) M.C.—The Club was recently formed among the local Boy Scouts, and the Scoutmaster, the Rev. J. C. Field, kindly consented to become President. Since then several new members have joined and there is every prospect of the Club being very successful. *Secretary*: Cecil Fowler, P.O. Box 25, Koffiefontein, South Africa.

Preston M.C.—Meccano enthusiasts in Preston will be glad to know that a Club has been formed with Mr. A. Bibby as the Leader. Meetings are held every Friday in the Lyric Room, Avenham Street, at 7-30 p.m., and boys wishing to join the Club should interview the *Secretary*, Mr. J. R. Drysdale, Assistant Manager at Messrs. Merigold Bros. Club roll: 16.

Newcastle Model Engineers' M.C.—Meets regularly in the Albany Café every other Wednesday at 7-30 p.m. All Meccano boys are cordially invited to attend and further particulars may be had from the Leader, Mr. B. Gilbey, 205, Back Welbeck Road, Byker, Newcastle, or from the *Secretary*, J. T. Stothard, 71, Walker Road, Byker, Newcastle.

Ibrox and District (Glasgow) M.C.—Has been fortunate in securing a Club room, and many enjoyable evenings are spent with Meccano and Hornby trains. Members are very enthusiastic and all boys wishing to join are requested to communicate with the *Secretary*, A. Lyle, 185, Copland Road, Ibrox, Glasgow. S.W.

Droylsden (Manchester) M.C.—Owing to the resignation of Mr. T. Hemmings, the Leader, Mr. A. E. Walker, has kindly consented to take his place. An interesting programme is being carried out, including Model-building, Competitions, Lectures and Contractors' Nights. Club roll: 9. *Secretary*: F. Shorrock, 23, West Drive, Droylsden, Manchester.

Christ Church (Stratford, E.15) M.C.—Has adopted an ingenious idea for recruiting new members. Show cards bearing the Club's name have been printed and the local newsagent puts one in every "*M.M.*" sold. The Vicar has kindly lent a Club room and the membership is steadily increasing. Club roll: 11. *Secretary*: R. H. Bentley, 81, Abbey Lane, Stratford, London, E.15.

Sheffield M.C.—Has been successful in obtaining an adult Leader and a Club room. Meccano enthusiasts who are interested should write to or visit the *Leader*, Mr. S. Rodgers, 2, Low Street, Park, Sheffield.

Vines (Rochester) M.C.—The first meeting was held on January 10th, after the Club had been fortunate in securing an Adult Leader and a Club room. Club roll: 11. Any Meccano boy wishing to join should communicate with C. Bassett, 12, Albert Road, Rochester.

Proposed Clubs

Reading M.C.—A great attempt is being made to secure a Club room. In the meantime the members, who number 15, are keeping together by arranging visits to various works in the district. *Secretary*: H. G. Rogers, 135, Liverpool Road, Reading.

Mansfield M.C.—It is hoped shortly to establish a Club in Mansfield, and the organisers at present are trying to find an adult Leader and a suitable room. H. R. Wright, "Rotherwood," Marlborough Terrace, Mansfield, would be pleased to hear from all Meccano boys interested.

Walton (Liverpool) M.C.—Great efforts are being made to form a Club in Walton and all boys interested are asked to get into touch with Master F. Cartwright, 13d, Walton Village, Walton, Liverpool. A Leader and a Club room are also needed.

Leek (Staffs.) M.C.—C. S. Fowler, 19, John Street, Leek, Staffs., is endeavouring to form a Club and would like to hear from all boys interested. An adult Leader and a Club room are urgently needed.

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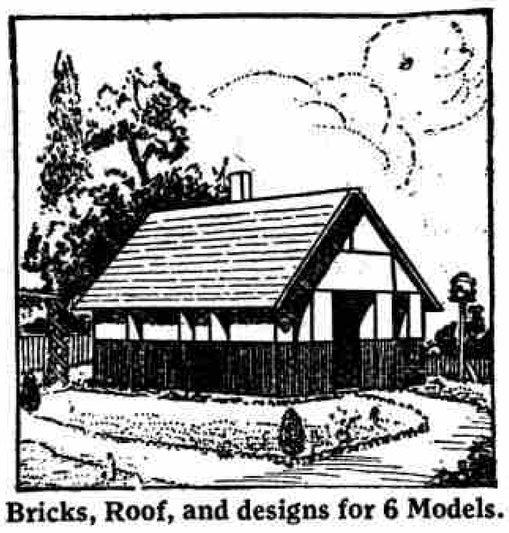
Model from Box 0. Series B. Price 2/-



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Some examples of what can be done with this delightful Constructional Toy. Write for complete Illustrated List, and name of your nearest agent.

Complete with Bricks, Roof, 12 designs, White Paling Fences and Trees.

Model from Box A. Series B. Price 5/-

Pair of Houses.

Containing 18 original designs with Bricks, Thatched and other Roofs. Packed in well-made wooden box with lift-out tray containing Trees and Fences.

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Write for a free booklet about Seccotine.

Engineering News of the Month

Wembley in 1925

It is announced that the British Engineering Association will not take part officially at Wembley this year, and that electrical engineers and motor manufacturers also will not exhibit. This means that the shipbuilding, marine, mechanical, and general engineering section will not be organised by the British Engineering Association, although individual firms may exhibit their products if they decide to do so. It is stated that the organisation of the Electrical Section of the Exhibition last year cost £1,000,000, and it is doubtful whether the returns justified the expenditure.

Wembley without the Palace of Engineering would undoubtedly be deprived of much of its interest and attraction. It has been suggested that a Housing Exhibition might be arranged in the former Palace of Engineering, but we think an alternative suggestion—that of an exhibition commemorating the centenary of the Steam Railway—would be more acceptable, at any rate to readers of the "*M.M.*"

* * * *

Moving Mountain Bursts Water Main

We mentioned in these notes last month that a mountain in the Rhymney Valley, Wales, was on the move. Since the date of that announcement the movement has continued, and great damage has been caused to the gas mains and to a new water main only recently laid, at a cost of over £250,000. The damage resulted in cutting off the water supply of 100,000 people in the Rhymney Valley and is the most serious fracture of a water main yet experienced. The engineers, by working without intermission, managed to save the main road from being washed away. If the water had not been promptly cut off at its source, both the road and railway would certainly have been washed away. The engineers with their staff, also worked hard to restore the water supply and the pipes were repaired with promptitude, which was particularly fortunate in view of the large area affected.

Troedyrhiwfrwch, the threatened village, is in the coalfield zone, and is situated in a narrow valley between high mountains. Subsidence of the land is very common in the district, the whole of the Rhondda Valley having dropped quite twelve inches in the last generation. Ever since the recent heavy rains, the Rhymney Valley mountain has been giving trouble over a distance of some seven miles. There was a tremendous landslide here some years ago, and the local authorities of the Great Western Railway Company view the present movement with great apprehension.

New Ships for the German Navy

Many of the battleships, cruisers and torpedo-boats of the German navy have recently been re-armoured with guns of a new type. In many cases alterations have been made in the construction of the ships themselves—the cruiser "*Nymphe*," for instance, has had her ram bow replaced by a graceful clipper stem. A new cruiser "*Emden*" was launched at Keil on 7th January, and has a centre-line battery of ten 5.9" guns, which is a very heavy armament when considered with her displacement. A new destroyer of large and powerful design will be laid down shortly.

* * * *

Improving White Star Liners

The "Big Four" of the White Star Line, the "*Adriatic*," "*Baltic*," "*Cedric*," and "*Celtic*" (each of which has a tonnage between 21,000 and 25,000) are widely known as being among the steadiest sea-going steamers plying across the Atlantic. Heavy expense is being incurred by the owners in improving the second and third-class accommodation on the "*Baltic*," "*Cedric*," and "*Celtic*" to meet the demand for increased comfort at low rates and thus appeal to those of moderate means.

In the new second-class accommodation, cabins will be re-arranged, re-modelled, and generally made more attractive. There will be spacious lounges, with oak-block floors for dancing, and the decorations and furnishings will be of the most tasteful character. In the third-class quarters, new features are ladies' rooms, smoking-rooms for men, children's play-rooms, barbers' shops, and shops for the sale of confectionery and fancy articles.

* * * *

New Liners

Three new Cunard liners are being built and will be in commission this season. The "*Corinthia*" (29,000 tons) will carry first, second and third-class passengers on the Liverpool–New York route, but before entering this service she will make a cruise round the world. The "*Alounia*" and the "*Ascania*" (14,000 tons each) will carry cabin and third-class passengers, and will work the Canadian service.

* * * *

Widening a Bridge

The English bridge at Shrewsbury is to be reconstructed and the approaches widened, at a cost of £76,000. The contract has been placed and the work will commence immediately.

"Mechanical Clerks"—Machines for Office Work

At the new office of the London School of Economics (Houghton Street, Aldwych, London, W.C.) there is a "machinery room," which we understand is open to the general public. Here are nearly 40 different machines that do similar work to that usually done by human beings—but the machines do it more quickly and efficiently. One machine (which costs £3,000) produces information usually compiled from many ledgers. Another, known asthe "MillionaireCostingMachine," is 4 ft. in length and has hundreds of adjustable parts, yet "a child can work it," as the saying is. A third machine, a wonderful typewriter with 96 characters and an interchangeable keyboard, will write in any language. There is, indeed, literally no office work that cannot be done by machinery at this wonderful exhibition.

* * * *

Fuel Economy

Two inventions are announced this month, both of which make for greater economy in fuel consumption and in boiler space. One is a new type of steam boiler, the use of which has led to the discovery that fuel possesses a hitherto unsuspected power. In this new boiler, oil fuel is mixed with air, and the mixture forced through a valve into a steel container holding water. It is then ignited and an intensely hot flame, nearly 4,000° Fahr., burns in water and forms steam. The mixture of oil and air is so regulated that pure carbonic acid gas is generated as the product of combustion. This, with the steam, passes into a simple boiler or reservoir that supplies the engine. It is stated that the cost of the boiler is only half that of an ordinary boiler, and that it uses only half the amount of fuel for the same quantity of steam produced.

The second invention is being exhaustively tested at Rugby on a 1,500 h.p. plant. In this the water is gradually raised to a temperature of over 700° Fahr. by a special system of superheating. It is kept at a pressure of 3,200 lb. per square inch, at which pressure the slightest additional amount of heat converts it into steam. The steam is then reduced in pressure and is used in a steam turbine. A great economy in fuel is claimed and the method also permits of a saving of about 30 per cent. in boiler space. It is stated, in a preliminary report, that the turbine worked with this new steam-producer is more efficient and more economical than any form of internal combustion engine.

IGRANIC

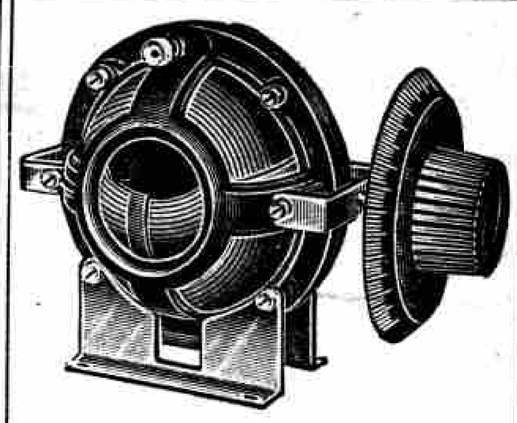
F Type Variometer

The great feature of this component is in the stator moulding which has been "skeletonised." Instead of the half stator moulding being a solid annular piece, the outer and inner rings are joined by four webs. In addition the rotor winding is self-supporting and thus the usual rotor molding is dispensed with.

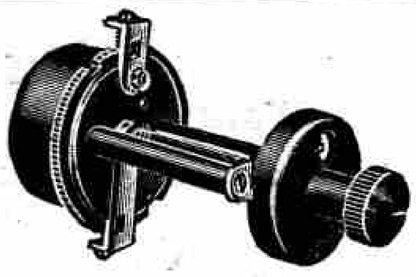
The elimination of moulded material results in a very big improvement in efficiency, due to the reduction of self-capacity and to the fact that the clearance between rotor and stator windings is very small.

It is ideal for aerial tuning in either crystal or valve sets receiving B.B.C. stations. Supplied complete for fixing.

Price (250-600 metres) **12s. 6d.**

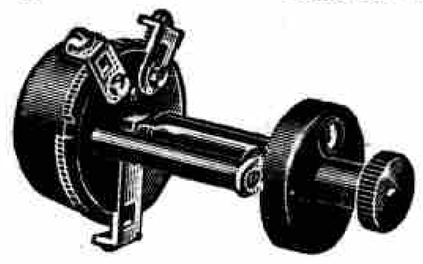


IGRANIC
F Type Variometer



IGRANIC
Variable Grid-Leak

It gives a continuous variation of resistance from 0 to 5 megohms. Conducting parts are separated from the control knob and the metal spindle divided by insulating material in order to eliminate hand-capacity effects. Note the neat and original indicating dial. Single hole fixing. Price **8s. 6d.**



IGRANIC
High Resistance Potentiometer
30,000 ohms.

It is suitable for all purposes to which an ordinary low resistance potentiometer is applicable, and is particularly recommended for use with grid cells for the control of potential applied to the grids of low-frequency amplifying valves. The high resistance value and consequent low current consumption render the useful life of the grid cells considerably longer than when a low resistance potentiometer is employed.
Smooth and even adjustment facilitates critical variations of grid potential and ensures silence in operation. Single hole fixing.

Price **8s. 6d.**

Build these new devices into your receiver—

and notice the improvement

That Grid-Leak you are so doubtful about, for instance—let the Igranic Variable Grid-Leak show it how it *ought* to do its job! You cannot expect a *fixed* Grid Leak to operate at maximum efficiency under *all* conditions. The Igranic Variable Grid-Leak allows of a smooth and continuous variation of resistance from 0 to 5 megohms, and thus ensures that the grid condenser discharges at precisely the correct rate.

The *better* performance you obtain from this Igranic Grid-Leak you will obtain also from all Igranic Components—so that you will

Build a *better* set with

Write for List Z. 400.

RADIO **IGRANIC** DEVICES

Write for List Z. 400.

They include Honeycomb Coils, Fixed Condensers, Filament Rheostats, Inter-valve Transformers, Variometers, Vario-couplers, Bi-plug Coil Holders, Tri-plug Coil Holders, Battery Potentiometers, Vernier Friction Pencils, etc.

All carry a six months' guarantee, and are stocked by all reputable dealers.

IGRANIC ELECTRIC CO. LTD.,
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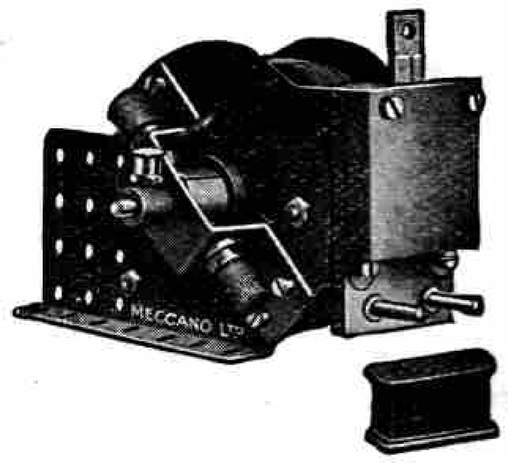
A New Meccano Motor



The above is an illustration of the 100/230-volt Meccano Electric Motor. It may be employed for any purpose for which a small motor is suitable, but it is specially adapted for running Meccano models. The side plates are perforated with standard equidistant holes, thus allowing the motor to be built into any Meccano model.

The motor is specially designed for connection with the electric light main, and is supplied for 100/120 volts or 200/230 volts (alternating or direct). It is fitted with a length of flex (6 feet), an insulated plug for connection with the motor terminals, and an adaptor for connection with an ordinary lamp socket.

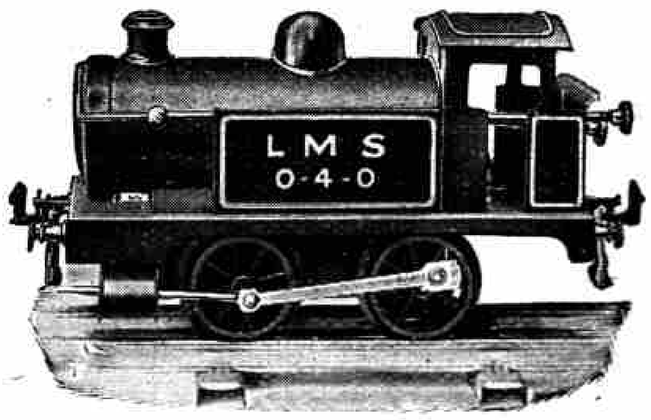
A suitable resistance is required when the motor is run with a 200/230-volt current. This is supplied by connecting a 60-watt lamp in series with the motor. A board, on which are mounted a suitable lamp holder (lamp not included), and a switch is provided separately.

100/230-volt Motor, price **32/6**

Lamp Board (with Lamp Holder and Switch) price **4/6**

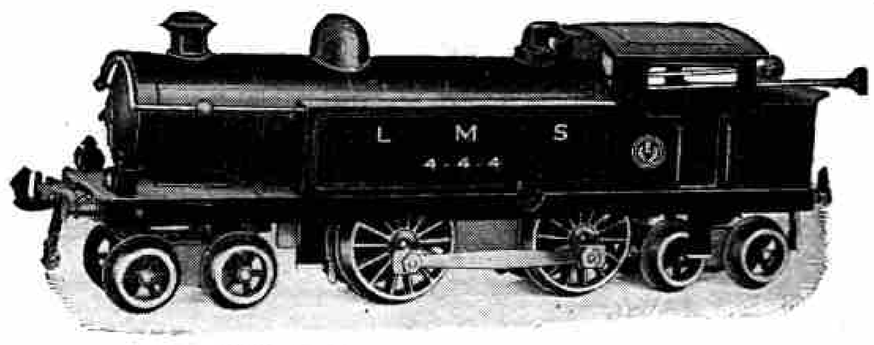
FROM ANY MECCANO DEALER

HORNBY TANK LOCOS



HORNBY No. 1 TANK LOCO

Strong and durable loco capable of any amount of hard work; richly enamelled and highly finished; fitted with reversing gear, brake and governor.
Gauge 0, in colours to represent L.M.S. or L.N.E.R. Companies' Locos **12/6**

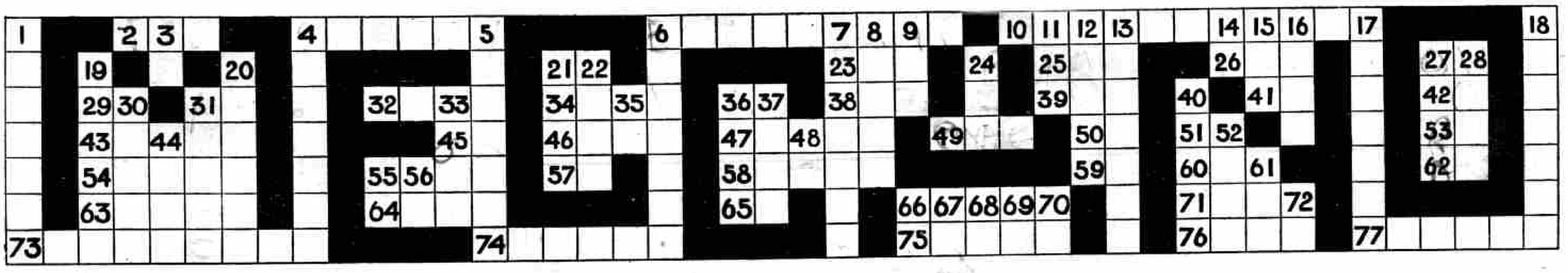


HORNBY No. 2 TANK LOCO

Powerful model embodying all the characteristics of the Hornby series. It is 11½" in length and is fitted at both ends with a four-wheeled bogey. Beautifully finished in colours; lettered L.M.S. or L.N.E.R., with reversing gear, brake and governor. Suitable for 2 ft. radius rails only. Price ... **30/-**

FROM ALL MECCANO DEALERS

Puzzle No. 69.



HORIZONTAL : 2. A crown ; 4. West Indian Mulberry ; 6. Superfluous ; 10 Joint working ; 21. To live ; 23. Mottled appearance in wood ; 25. Unit of French land measure ; 26. Rested ; 27. Gold ; 29. In continuance ; 31. Degree (abbrev.) ; 32. A fibre ; 34. Dry ; 36. Pronoun ; 38. Skill ; 39. Viscous liquid ; 41. Pronoun. 42. To extend ; 43. Italian city ; 45. Conjunction ; 46. A ceremony ; 47. Belgian town ; 49. Female sheep ; 50. Compare (abbrev.) ; 51. Article ; 53. Since ; 54. In a line with ; 55. A wheel ; 57. Preposition ; 58. British possession ; 59. Call to excite attention ; 60. Procure ; 62. Pronoun ; 63. Metric weight ; 64. Talk familiarly ; 65. Motor index letters for a Lancashire town ; 66. Mosaic law ; 71. A bird ; 73. Toothache ; 74. To ensnare ; 75. To deliver a speech ; 76. Therefore ; 77. A copy.

VERTICAL : 1. A constructional toy ; 3. Latin unit of weight ; 4. Quickly ; 5. Tell ; 6. Growing in waste places ; 7. Active ; 8. Main artery ; 9. A difficulty ; 11. Grassy plant ; 12. Plant used as spinach ; 13. Carry out ; 14. A god in Norse mythology ; 15. A river ; 16. Likewise ; 17. Insular ; 18. The inner distinctive nature ; 19. Fruit of a plant of the Nightshade family ; 20. Ornamental shelf ; 21. District of Uganda ; 22. An island ; 24. Adverb ; 27. Ancient Irish writing ; 28. A flower ; 30. A dress fabric ; 31. Sweet juice from a tree ; 33. A small quantity ; 35. Pronoun ; 36. Used in harnessing a draught horse ; 37. Dash ; 40. Rise of tide in a river ; 44. Granted ; 48. Call letters of a broadcasting station reversed ; 52. Dear ; 55. Religion (abbrev.) ; 56. Exclamation ; 61. Four-handed drinking cup ; 66. Preposition ; 67. Conjunction ; 68. God of Egyptian mythology ; 69. Denoting presence ; 70. Pronoun ; 72. Interjection.

Cross Word Puzzle Competition

First Prize : Meccano Goods value £1 : 1 : 0

Second Prize : Meccano Goods value 10 /6

Third Prize : Meccano Goods value 5 /–

EVERY reader who wishes to enter for this competition must send in the solutions of the two Cross Word Puzzles, Nos. 69 and 70, together with a Cross Word Puzzle of his own invention.

All puzzles submitted must be original and must not have been published previously. They must not contain Christian names, and if the names of any historical characters are used these must be thoroughly well known. Slang words must not be used, and all abbreviations employed must be specified as such unless they are in common every-day use.

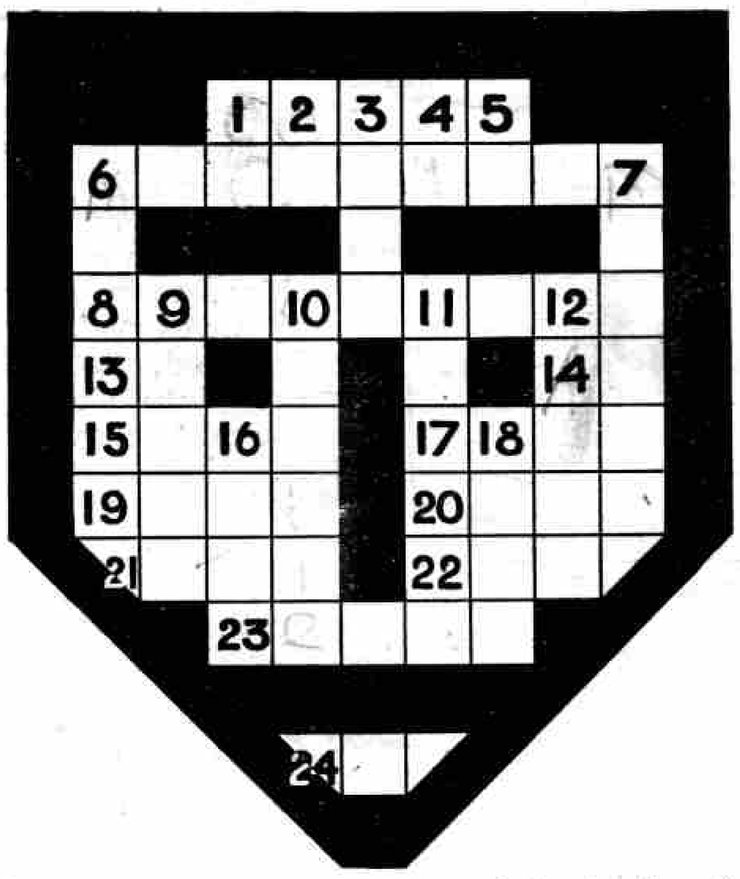
The diagrams of Puzzles 69 and 70 are on much too small a scale for actual working. They should not be cut out of the page, therefore, but should be copied at least four times the size on to a sheet of paper. If an entry includes more than one sheet of paper, the name and address of the competitor must appear on each sheet.

Competitors should note that this month preference will be given to original puzzles which have some bearing upon the names "Meccano" or "Hornby," or which have a Meccano model outline as their basis.

For the information of new readers who may not be familiar with the method of working Cross Word Puzzles, we would point out that a specimen puzzle, fully explained and worked out, was given in our January issue.

Entries for this competition must reach this office not later than 31st March.

Puzzle No. 70.



HORIZONTAL : 1. A beverage ; 6. Construction of a machine ; 8. Utter ruin ; 13. Abbreviation for an American State ; 14. Because ; 15. Detached piece of land ; 17. A course ; 19. Belonging to bovine genus ; 20. Concerning ; 21. Anything that obstructs passage ; 22. To make an object of trade ; 23. English port ; 24. Water-cress.

VERTICAL : 1. Chapters (abbrev.) ; 2. Denoting surprise ; 3. Mohammedan judge ; 4. Preposition ; 5. South American animal ; 6. Describing clearly ; 7. Form of roof ; 9. A frame ; 10. For two ; 11. Grew ; 12. Consisting of the stem of a grassy plant ; 16. Commendation ; 18. Term in cricket.

Puzzle No. 71.

What birds are indicated by the following :—

1. What everyone does at meals ; 2. A letter of the alphabet ; 3. A kind of pastry and a preposition ; 4. Food for horses and a measure of length ; 5. A kind of country and a female bird ; 6. A pronoun and a preposition ; 7. A verb and a preposition ; 8. A ruler and a catcher ; 9. A celebrated architect ; 10. A hard fruit and to produce.

Puzzle No. 72.

Dick (to Tom coming home from fishing) : "Did you catch anything, Tom ?"
Tom : "Yes, a big one."
Dick : "How big was it ?"
Tom : "Its head was 9 inches long."
Dick : "How long was its tail ?"
Tom : "As long as its head and half as long as its back."
Dick : "And how long was its back ?"
Tom : "As long as its head and tail put together."
How long was Tom's fish ?

* * * *

Puzzle No. 73.

A draper sold ladies' handkerchiefs at 4½d. each or three for a shilling. One day he saw his assistant sell a lady one handkerchief, and after the lady had gone he said : "Why did you not sell the lady three handkerchiefs ?" The assistant replied : "Because you have the same profit on one handkerchief as you have on three."

How much did the handkerchiefs cost the draper ?

* * * *

Puzzle No. 74.

The following numbers indicate the position of letters in a word consisting of eight letters, and the definitions give the meanings of the words formed by these letters. The whole word means something very pleasant :—1, 6, 7—Something dried in the sun ; 8, 6, 7—To tell ; 8, 6, 5—Unhappy ; 5, 4, 6, 3—Shows the time of day ; 8, 2, 3, 4, 5—Substantial ; 3, 2, 6, 5—A burden ; 3, 6, 5—A youth ; 8, 6, 4, 3—Seen at sea.

* * * *

Puzzle No. 75.

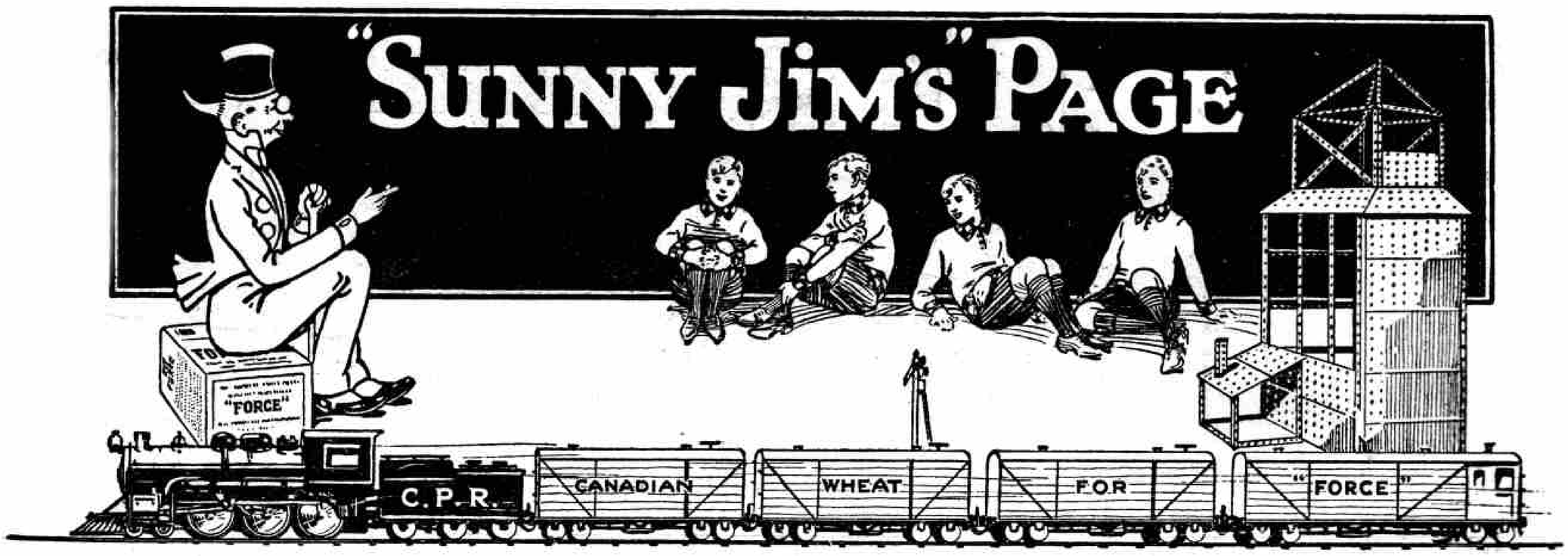
Re-arrange the following letters so that each horizontal line will give a complete word and so that the initials and finals read downward will form the names of two well-known poets.

A A A A A C
D D D E E E
G G I I L L
L L L N N N
O O O P R R
S T T T W Y

* * * *

Puzzle No. 76.

Mr. Ree went to the dentist, who afterwards made out his bill by writing down six consecutive figures. What were these figures ?

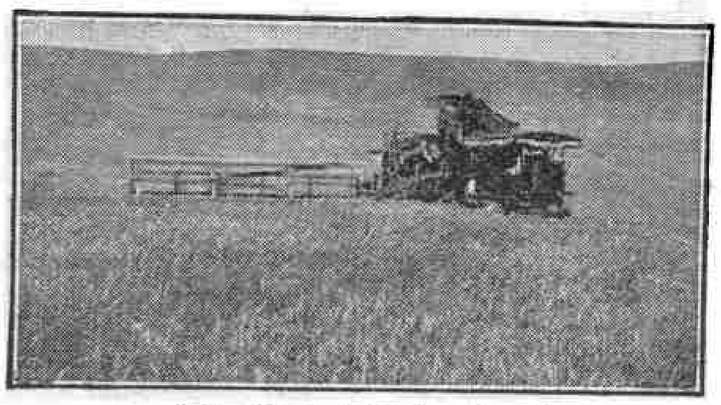


SUNNY JIM TAKES MECCANO BOYS ON TRIP THROUGH CANADA'S WHEATLANDS

Ploughs eating their way through soil of Canadian Wheat Farm

If you had been driving one of these big power ploughs somewhere round about the time this photograph was taken, standing out against the landscape you might have seen the familiar figure of our old friend Sunny Jim, and with him, two keen-eyed boys.

These two lucky boys were touring the wheatlands which supply the wheat fromwhich"FORCE" is made, and Sunny Jim had taken them to see the great ploughs eating their way through the soil of a Canadian wheat farm. Later they watched the wheat being sown, and saw the giant cultivators at work. Throughout the Spring and Summer they traversed these horizon-wide acres of growing wheat, learning how only the best hard wheat is grown for " FORCE," and how wheat, the king of cereals, contains in itself alone sufficient of everything necessary for man to live.



A Reaper and Binder at work

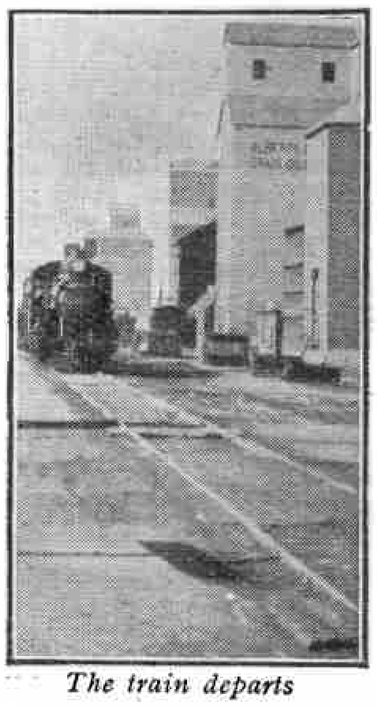
The wheat was standing as high as their heads when Dick, the younger of the two, came running to Harry with the exciting news that Sunny Jim was preparing to take them to the scene of the harvesting. In the distance could be heard the steady drone of the reaper and binder as it sheared its way through the standing wheat. At regular intervals, from the side of the machine, were shot sheaves of wheat, ready tied, to be stacked into shocks by the man following after, then to be carried to the threshing machine.

What a dust and hustle there is around this monster thresher that swallows the cut wheat as fast as it can be fed. The wheat grain pours out of a chute in the centre of the machine, while the straw and chaff is shot away through the " gun " like funnel you can see in the picture.

In four-wheeled carts the grain is now trundled off to the railway station siding where it is put into the special " wheat cars " of the Canadian Pacific Railway.

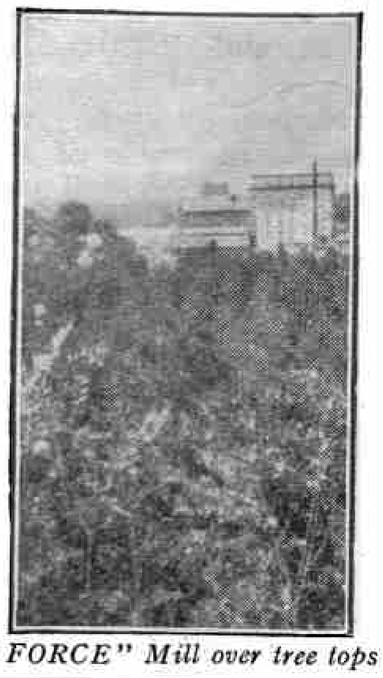
Loading wheat for rail from threshing machine

Dick and Harry were busy watching the loading when Sunny Jim brought the glorious news that all three of them were to travel to the " FORCE " mills on the footplate of the engine. Up they scrambled and soon they were tearing across the country at a terrific pace. After many hours journeying the mills at last hove in sight over the tree tops, and twenty minutes later they saw the wheat cars being shunted into the mill yard.



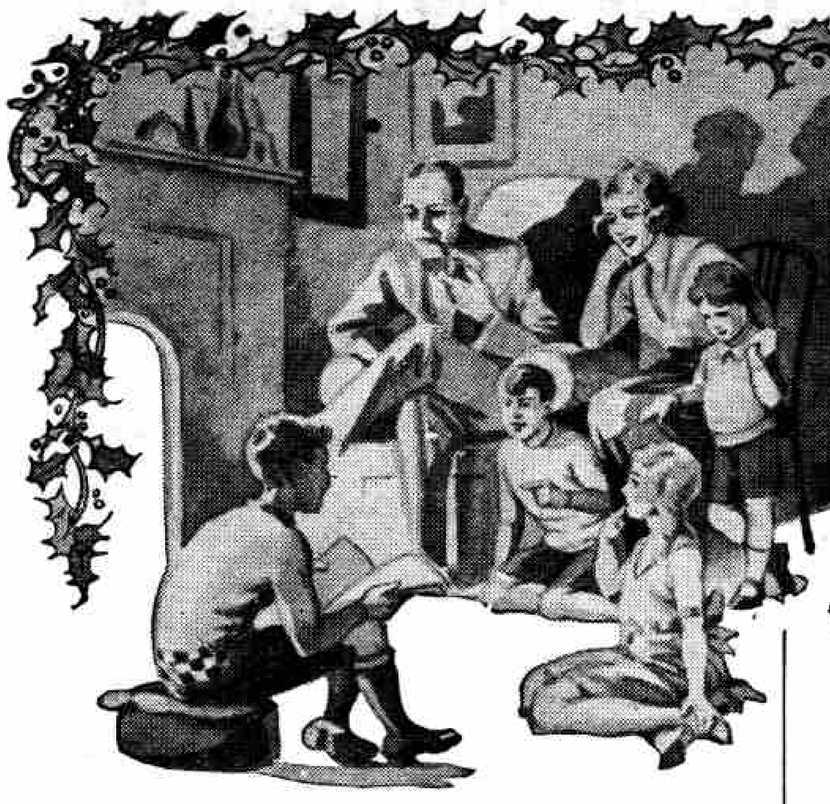
The train departs

" Now " said Sunny Jim, " you have seen the journey of the wheat from the seed to the mill. We shall next see the grain transformed into " FORCE " whole wheat flakes, toasted and malted—the food you like so much for breakfast with hot or cold milk, and which every grocer sells in the familiar 9½d. packet." " Do we start now? " said Dick. " No," answered Sunny Jim, " I have reserved this tour for to-morrow." Dick was disappointed, but was soon consoled when " Sunny Jim " brought them each a big plateful of " FORCE " and a tin of juicy peaches to eat with it.



" FORCE " Mill over tree tops

An account of Harry and Dick's exploration of the " FORCE " mills will appear on Sunny Jim's page later. From March 2nd until March 25th Sunny Jim himself will be at The Ideal Homes' Exhibition, Olympia, where you will find him at the " FORCE " Stand. Ask him to show you the Wheatland Panorama !



Fireside Fun

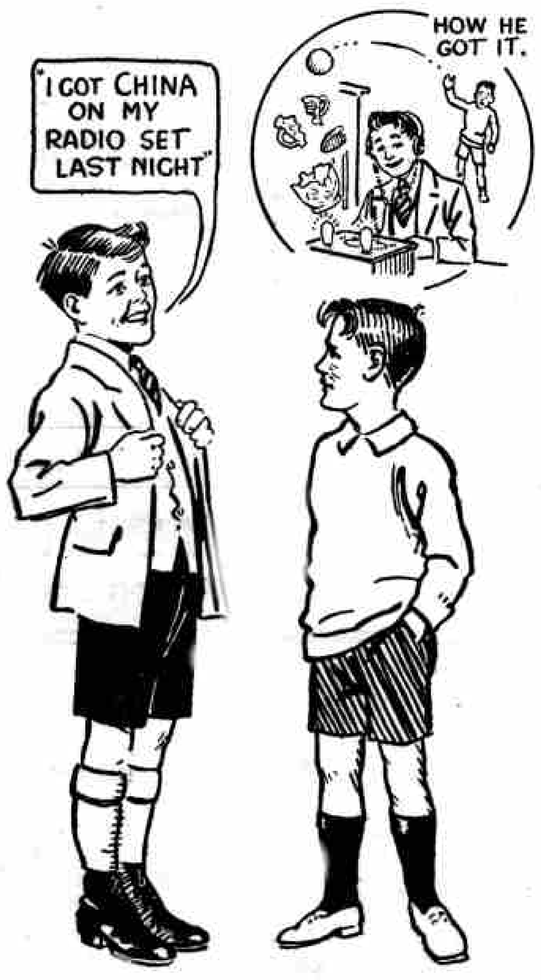
THE deluge of solutions of our last two Cross Word Puzzles was checked slightly by the greater difficulty of No. 61, but I was surprised at the number of readers who solved this puzzle, and also puzzle No. 60, correctly.

Last month I drew attention to the need for greater care in selecting definitions, and I am glad to see that there has been a remarkable improvement in this respect in the original Cross Word Puzzles submitted. This time also most readers remembered to write their names and addresses on each sheet of paper sent in, but even yet there were a few absent-minded ones who omitted to do this, and in one or two cases forgot to send any address at all!

I hope my readers will approve of the "Meccano" Cross Word Puzzle that heads this month's Puzzle Page. I am offering prizes for the solution of this and the "Face" puzzle, accompanied by an original puzzle. This month I shall give preference to original puzzles that have some bearing upon the names "Meccano" or "Hornby," or which take some Meccano Model as the basis of their design.

Full particulars of this contest will be found on the Puzzle Page.

TRUTH STRANGER THAN FICTION!



This Month's Short Story

Fat boy,
Big dinner,
Doctor's bill,
Now he's thinner.

* * * *

Old Gentleman: "Now, my little boy, why aren't you at school?"

Small Boy: "It's no use my going to school, sir."

Old Gentleman: "Why not?"

Small Boy: "Because I shouldn't be any use; I can't write or read or do anything!"

* * * *

NOT LIKELY!

Judge (to prisoner): "When were you born?"

Prisoner remains silent.

Judge: "Did you hear me? When is your birthday?"

Prisoner (sullenly): "What do you care? You ain't going to give me a birthday present!"

* * * *

Q. If a bear went into a draper's shop, what would he want?

A. Muslin (muzzling).

* * * *

Q. Why is a pianist like a prison warder?

A. Because he handles the keys.

* * * *

Q. When are roads annoyed with one another?

A. When they are cross roads.

* * * *

Teacher: "What is a distant relative?"

Tommy: "My brother George is one."

Teacher: "How can your brother be a distant relative?"

Tommy: "Because he lives in New Zealand."

* * * *

WHY THE CLERK WAS WORRIED!

"Spell your name!" said the court clerk sharply.

The witness began: O, double T, I, double U, E, double L, double—

"Wait!" ordered the clerk, "begin again!"

The witness repeated: O, double T, I, double U, E, double L, double U, double O—

"Your Honour!" roared the clerk, "I beg that this man be committed for contempt of court."

"What on earth is your name?" asked the Judge.

"My name is Otiwell Wood, and I spell it, O, double T, I, double U, E, double L, double U, double O. D."

Answer's to Last Month's Puzzles

Puzzle No. 60.

■	C	A	B	S	■	H	A	N	D	■
B	■	M	E	C	C	A	N	O	■	F
O	R	■	T	A	R	R	Y	■	M	E
A	I	M	■	N	A	P	■	B	A	T
T	O	O	L	■	N	■	B	O	R	E
■	T	I	E	R	■	R	A	N	K	■
R	O	S	E	■	W	■	D	E	E	R
O	U	T	■	H	A	G	■	S	T	Y
U	S	■	B	I	N	N	S	■	S	O
T	■	C	U	R	T	A	I	N	■	T
■	D	O	N	E	■	T	R	O	Y	■

No. 61. * * * *

■	■	■	M	E	A	N	D	E	R	■
■	S	C	A	R	E	■	E	V	I	C	T	■
■	T	A	P	I	R	■	V	I	G	I	A	■
G	A	S	■	C	I	V	I	L	■	B	I	B
R	I	T	E	■	E	E	L	■	R	O	L	L
A	D	E	P	T	■	R	■	A	I	L	S	A
P	■	■	A	I	R	S	H	I	P	■	■	R
P	L	A	C	E	■	I	■	R	O	B	I	N
L	I	F	T	■	C	O	D	■	N	A	M	E
E	A	T	■	T	O	N	I	C	■	R	A	Y
■	N	E	B	E	L	■	A	L	O	N	G	■
■	A	R	Y	A	N	■	N	O	R	S	E	■
■	■	■	E	L	E	V	A	T	E	■	■	■

No. 62. 1881.

* * * *

No. 63. The printer purchased 27 types.

* * * *

No. 64. The number is 18.

* * * *

No. 65. There were 79 apples to begin with.

* * * *

No. 66. The British prisoners were placed in 5, 7, 13, 15; the Italians in 1, 4, 12, 19; the French in 2, 9, 17, 20, the Germans in 3, 10, 11, 18; and the Russians in 6, 8, 14, 16.

* * * *

No. 67. The letter is "X."

* * * *

No. 68.

1. Call; 2. Awake; 3. Bolt; 4. Blot; 5. Abihu; 6. Garlic; 7. Ease.

Initials—Cabbage. Finals—Lettuce.

Q. Why is a dead horse like a garden wall?

A. Because there is cat's meat on both of them.

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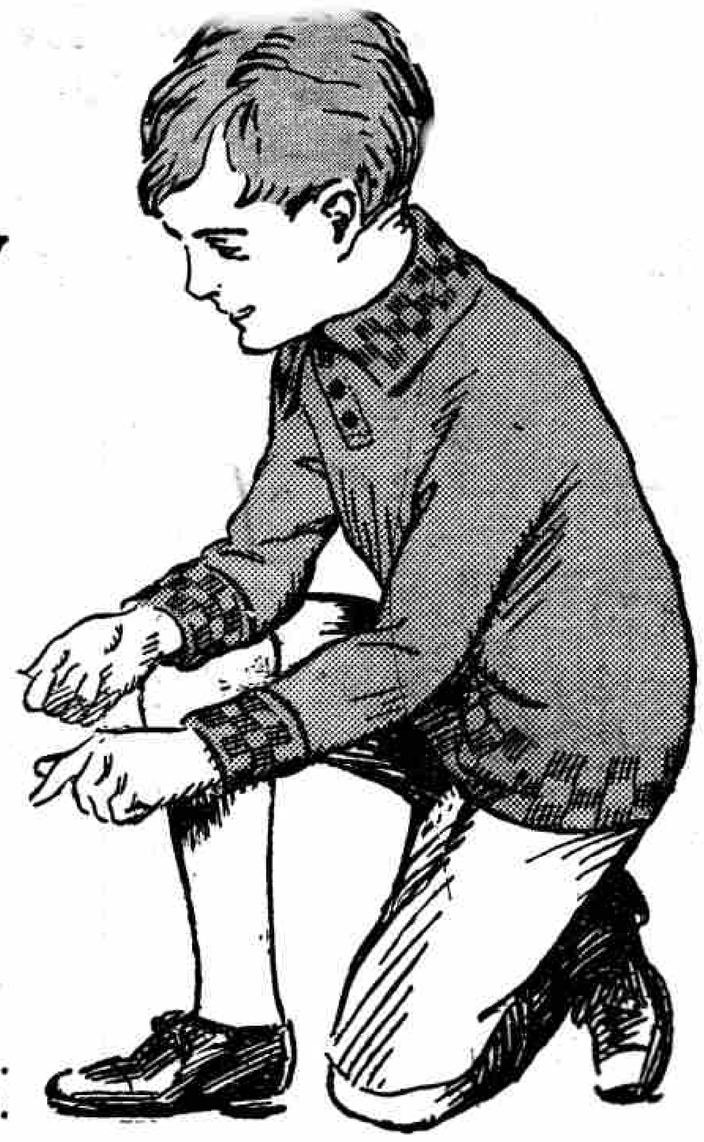

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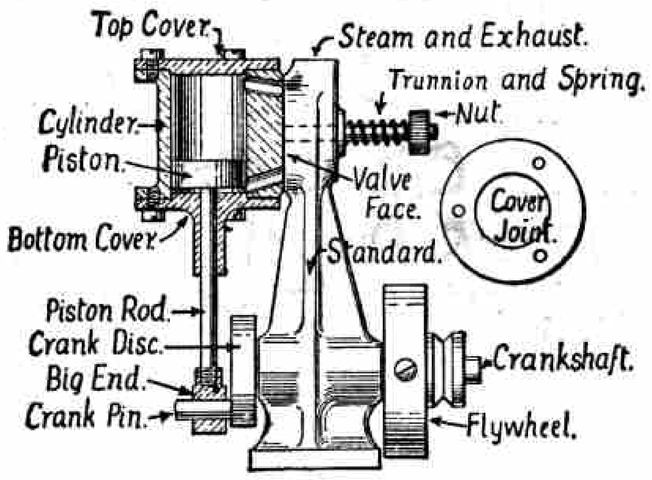

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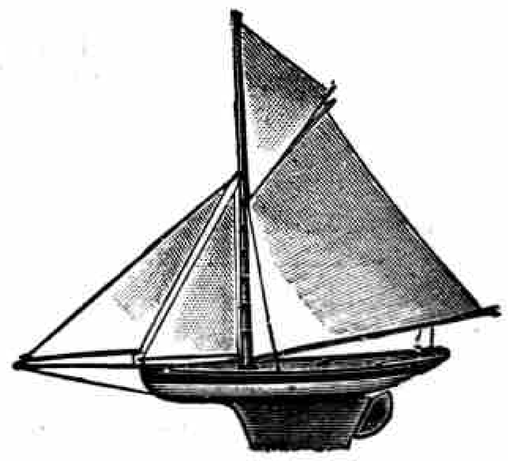

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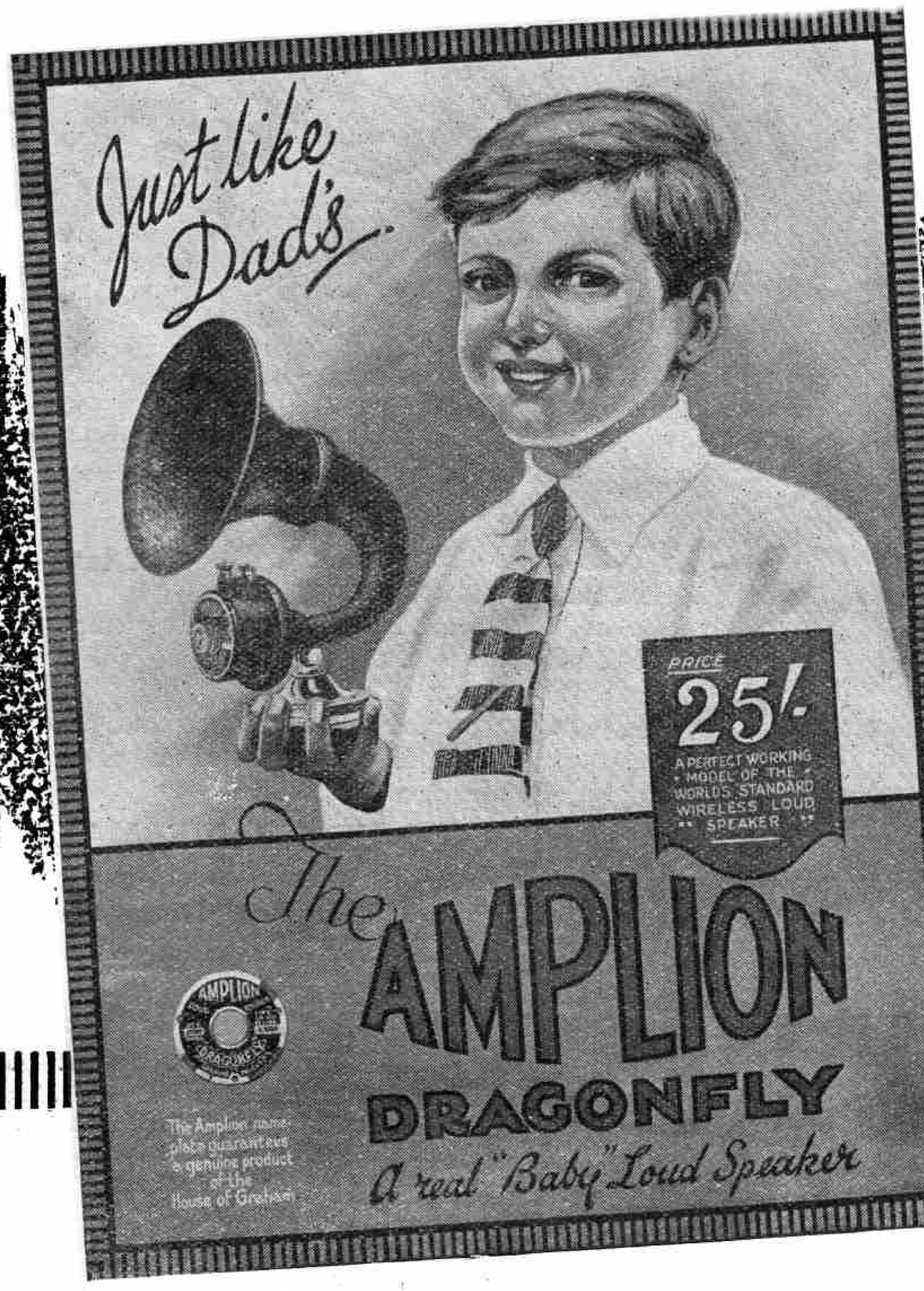

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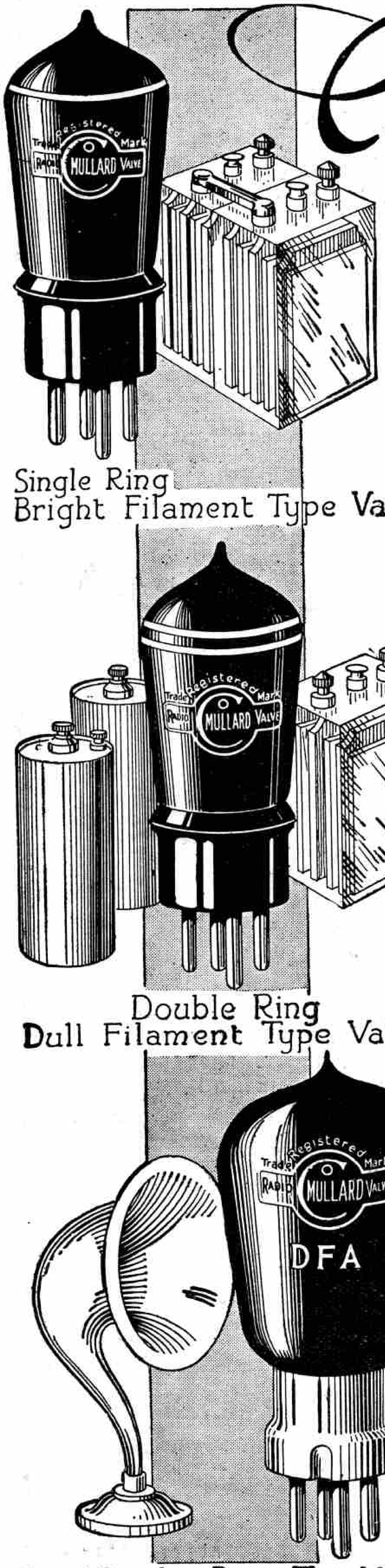

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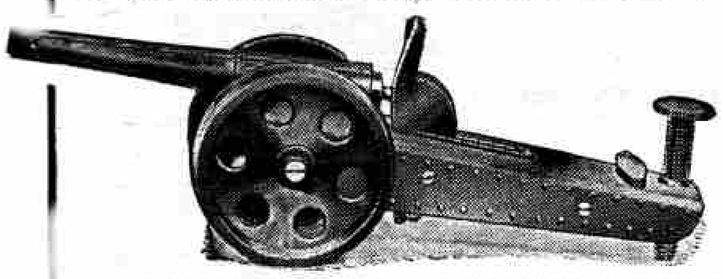

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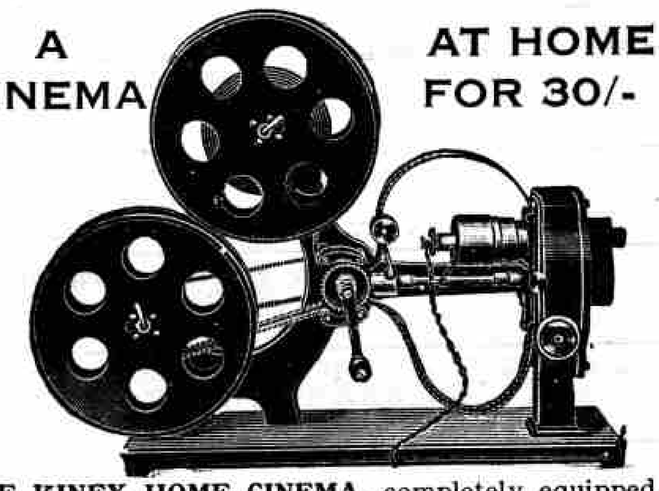

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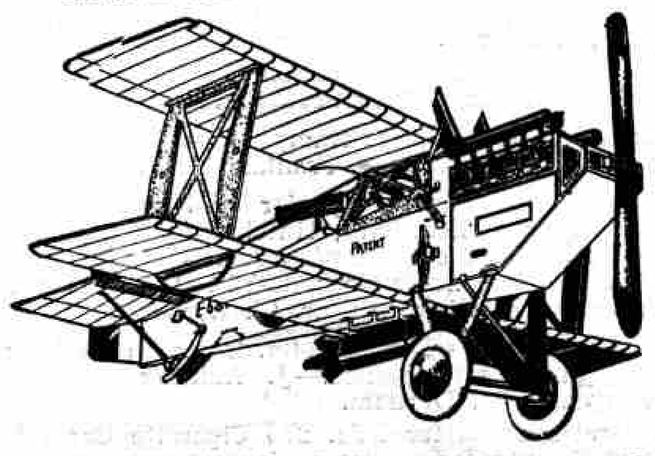

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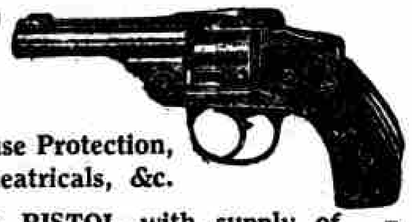

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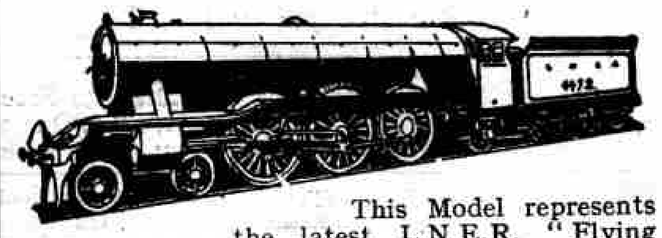

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Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 3d. per copy. It will be mailed direct from this office, 2/- for six issues and 4/- for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest; payment will be made for those published. Whilst every care will be taken of those submitted, the Editor does not accept responsibility for any loss or damage. A stamped addressed envelope should be sent where the contribution is to be returned if unacceptable.

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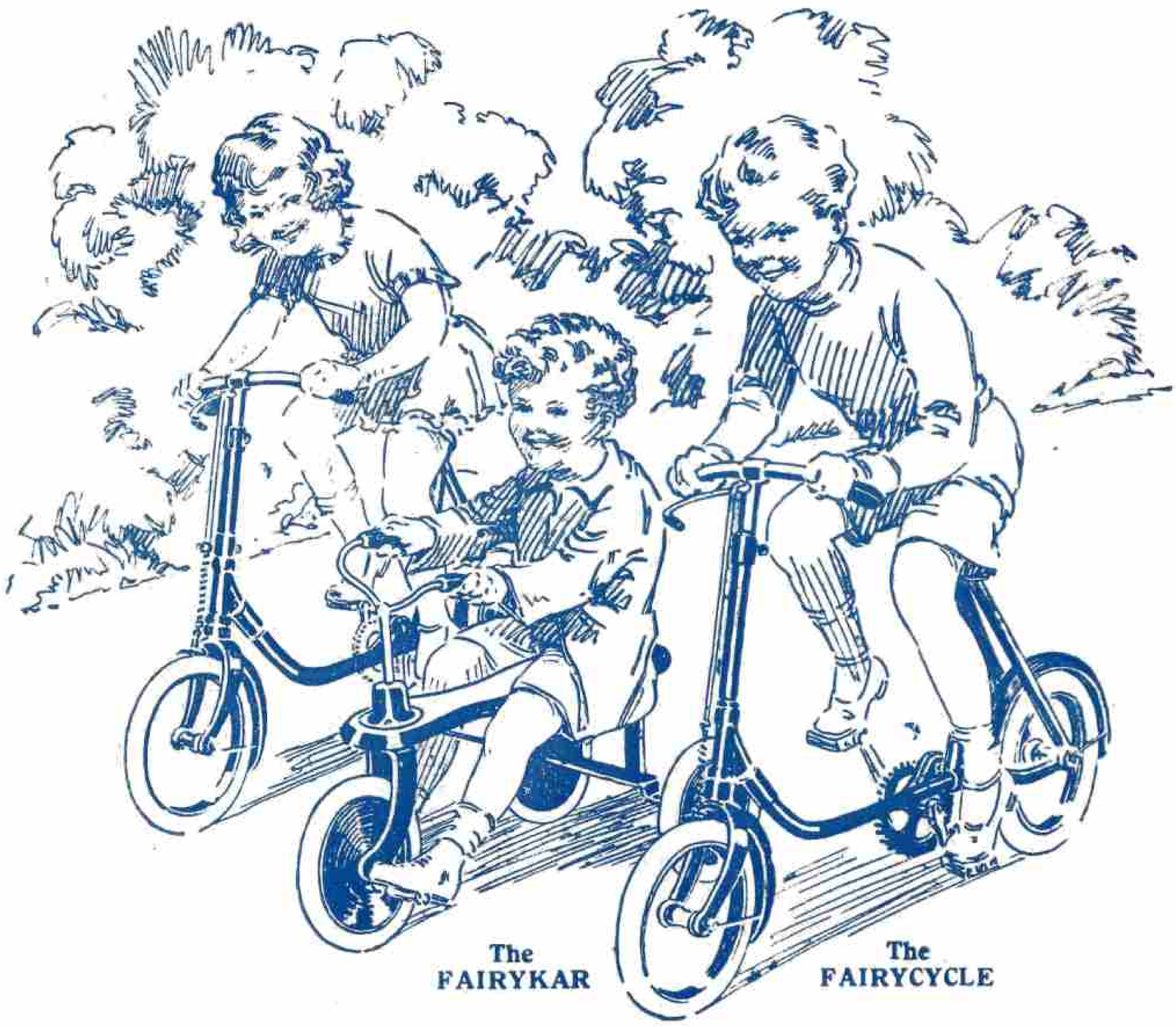

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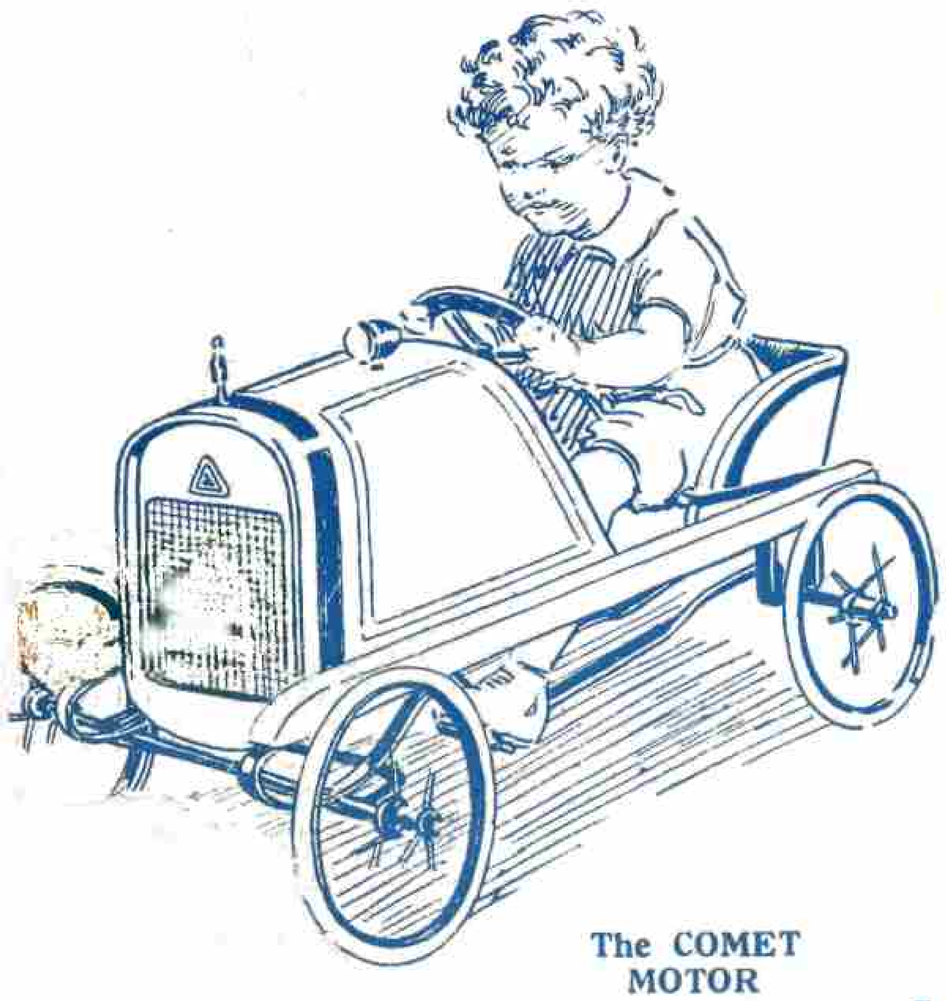

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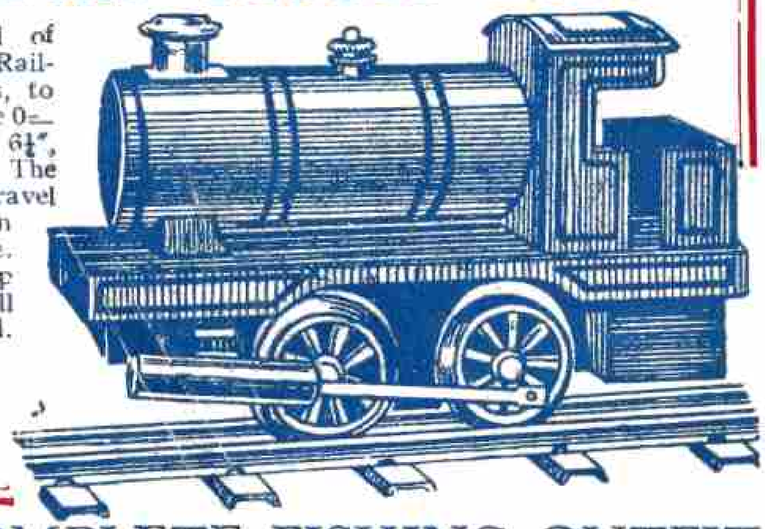

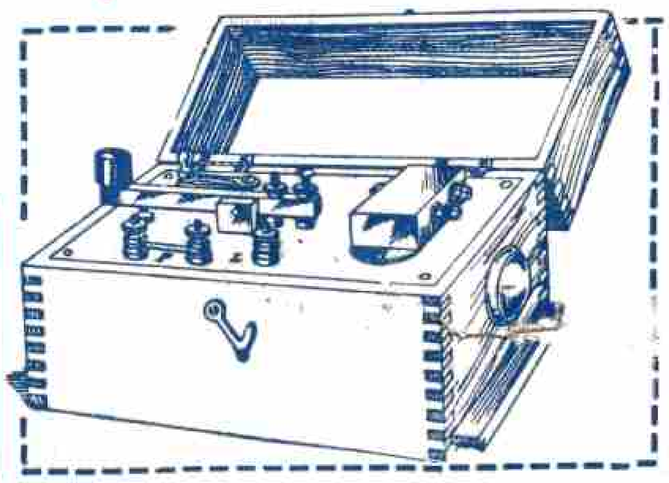

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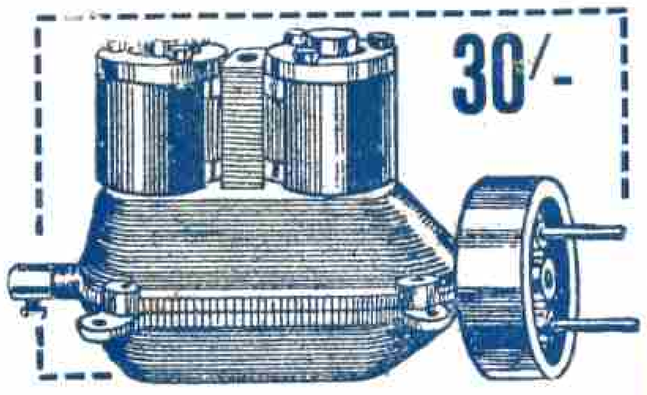

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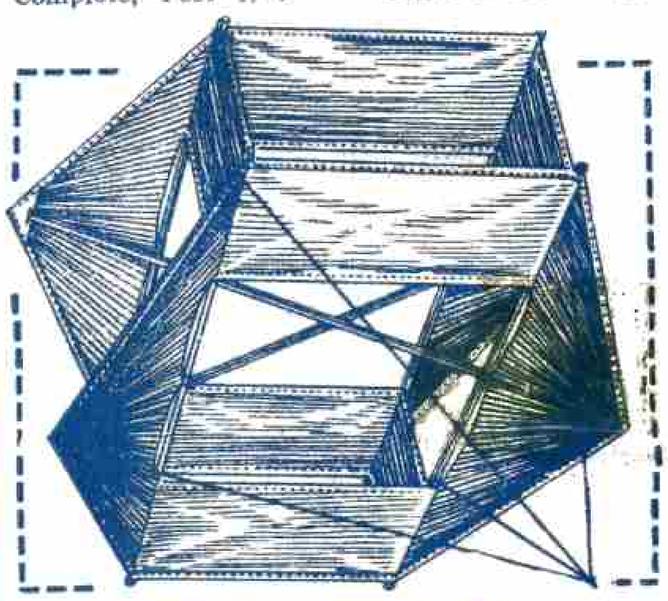

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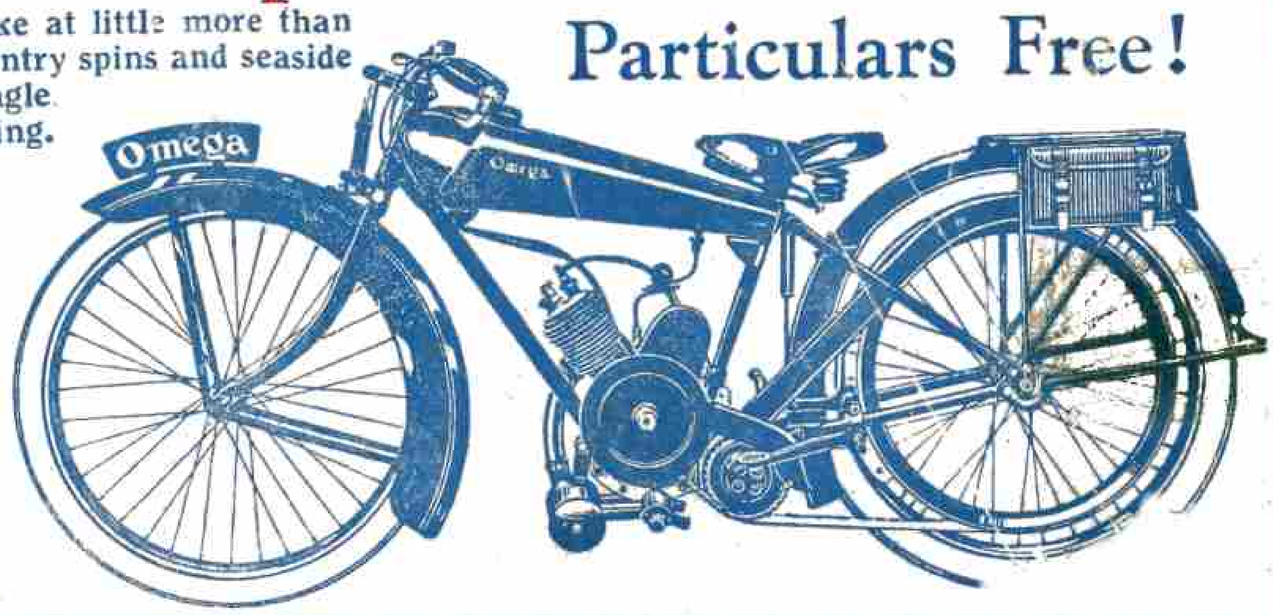

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